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October 15, 2021

Via electronic mail

Ryan Heacock, Project Manager
Santa Clara Valley Water District
Operations and Maintenance Environmental Support Unit
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Re: Fish and Aquatic Habitat Collaborative Effort Draft Program Environmental Impact Report

Dear Mr. Heacock:

California Trout, Inc. (CalTrout), Pacific Coast Federation of Fishermen's Associations (PCFFA), Northern California Council of Fly Fishers International (NCCFFI), and Guadalupe-Coyote Resource Conservation District (GCRCD) provide these comments in response to Santa Clara Valley Water District's (SCVWD or Valley Water) Fish and Aquatic Habitat Collaborative Effort (FAHCE) Draft Program Environmental Impact Report (DEIR) (June 30, 2021). We thank Valley Water for the additional time to review the document and provide comments.

Our organizations have been working with Valley Water on fishery issues through FAHCE for over two decades. We participated in the development of the FAHCE Settlement Agreement in the late 1990s, initialed it in 2003, and have worked to move it toward actual implementation since then. We have a vested interest in the successful permitting and implementation of the restoration program anticipated by the Agreement.[1] We provide these comments in furtherance of that interest. Our comments focus in particular on the need for Valley Water to work with stakeholders to develop specific management goals and measurable objectives related to fish restoration that can be used to develop and evaluate alternatives and inform the Adaptive Management Program (AMP). We want FAHCE to succeed and fear it will fail if specific management goals and measurable objectives are not established at the outset.

We are also providing these comments to the State Water Resources Control Board (State Water Board), San Francisco Bay Regional Water Quality Control Board (Regional Board), California Department of Fish and Wildlife (CDFW), and the National Marine Fisheries Service (NMFS), as each of these agencies is responsible for environmental review under either the California Environmental Quality Act (CEQA) or National Environmental Policy Act (NEPA) prior to making their respective permitting decisions.

As responsible agencies under CEQA, the State Water Board, Regional Board, and CDFW must independently review the Environmental Impact Report (EIR) to determine whether it is adequate to rely upon for purposes of their respective permitting decisions and make independent findings based on the analysis. The State Water Board, in particular, must determine whether the EIR is adequate to support amendment of Valley Water's water rights to permit ongoing water supply operations which have adverse environmental impacts on the Guadalupe River and Stevens Creek. Although not subject to CEQA, NMFS must comply with NEPA prior

[1] CalTrout, PCFFA, and NCCFFI continue to participate as Initialing Parties to the FAHCE Settlement Agreement. GCRCD has not participated as an Initialing Party since 2020, but continues to have a strong interest in achievement of the Agreement's overall management goals, namely to restore and maintain Chinook salmon and steelhead on the Guadalupe River, Stevens Creek, and Coyote Creek in good condition in accordance with applicable law.

to issuing any authorizations under the federal Endangered Species Act (ESA) for the project. It is important for efficient permitting and implementation going forward that Valley Water's EIR be adequate to serve as the basis for all agencies' compliance with CEQA and NEPA.

These comments are organized as follows. Section I provides an introduction and background information; Section II provides our comments on the DEIR; Section III summarizes our requests for further procedures; and Section IV concludes the comments. In support of these comments, we are providing an expert report from Dr. Joe Merz as Attachment 1, which includes a Minimum Viable Population Analysis as Attachment 1.1.

I.
INTRODUCTION

The environmental setting for the DEIR is the Guadalupe River and Stevens Creek (Two Creeks), and tributaries thereto, located in Santa Clara County. The Notice of Preparation issued in 2015 also included Coyote Creek, but measures to restore salmon and steelhead on that waterway will be addressed in the EIR for the Anderson Dam Seismic Retrofit Project. These waterways are tributary to the San Francisco Bay near San José and Mountain View and historically supported Chinook salmon and steelhead.[2]

In 1996, Guadalupe-Coyote Resource Conservation District (GCRCD) filed a complaint with the State Water Board alleging that Valley Water's appropriations caused harm to the public

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[2] Lanman RB, Hylkema L, Boone CM, Allée B, Castillo RO, et al., "Ancient DNA analysis of archaeological specimens extends Chinook salmon's known historic range to San Francisco Bay's tributaries and southernmost watershed," PLOS ONE 16(4): e0244470 (2021), *available at* https://www.rcdsantaclara.org/ancient-dna-sequencing-provides-proof-of-historic-chinook-in-guadalupe-river (last accessed Oct. 15, 2021); Leidy RA, Becker GS, Harvey BN, "Historical Distribution and Current Status of Steelhead/Rainbow Trout (Oncorhynchus mykiss) in Streams of the San Francisco Estuary" (2005), *available at* http://www.cemar.org/pdf/wholedoc2.pdf (last accessed Oct. 15, 2021).

trust resources of the Guadalupe River, Coyote Creek, Stevens Creek, and tributary creeks thereto (Three Creeks).[3] The complaint alleged that Valley Water did not release sufficient water to maintain fisheries in good condition downstream of its water storage and diversion facilities, and that these facilities blocked fish passage. The complaint also alleged Valley Water's operations had degraded the riparian vegetation, channel forms and substrates, and water quality of these creeks in violation of Fish and Game Code sections 5901, 5935 and 5937, the common law public trust doctrine, the Porter-Cologne Water Quality Control Act, and Water Code section 100.

Rather than litigate, the parties entered multilateral settlement discussions. Those discussions resulted in the FAHCE Settlement Agreement (FAHCE Agreement), which the parties, including GCRCD, CalTrout, PCFFA, and NCCFFI, initialed in 2003 and filed with the State Water Board.[4] The parties initialed rather than signed the FAHCE Agreement pending completion of certain conditions precedent to the Agreement being made effective.

In particular, Section 5.3 of the FAHCE Agreement committed Valley Water to prepare an EIR, as required by CEQA, prior to seeking regulatory approvals necessary to implement the provisions of the Agreement. Section 5.2 of the FAHCE Agreement anticipated environmental review and regulatory approvals would be completed within two years of the Agreement being initialed, and implementation would begin in 2005.

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[3] Although certain measures related to Coyote Creek have been shifted to the EIR for the Anderson Dam Seismic Retrofit Project, we continue to reference the Three Creeks in some places because the FAHCE Agreement includes Coyote Creek, as does the AMP evaluated in the DEIR.

[4] The State Water Board administratively closed the complaint some time after the Initialing Parties filed the FAHCE Agreement with the State Water Board in 2003, effectively dismissing the complaint without prejudice.

It has taken Valley Water more than 18 years from the date the FAHCE Agreement was initialed to prepare and publish the DEIR. Although Valley Water has undertaken early implementation of some restoration measures described in the FAHCE Agreement, in particular remediation of several of the many barriers to fish passage, its water supply operations and facilities continue to impact fish and other public trust resources.[5]

Implementation of the Proposed Project or an environmentally superior alternative is urgently needed to adequately protect fish on the Three Creeks and to bring Valley Water's appropriations into compliance with state and federal law. Chinook salmon and steelhead populations in the Three Creeks have declined further in the last 20 years due to several factors, including but not limited to Valley Water's operations and facilities. A genetics study that included steelhead trout from the Three Creeks and other San Francisco Bay tributaries found that they are part of the Central California Coast Steelhead Distinct Population Segment (DPS) and not the Central Valley steelhead DPS, and with no introgression from domesticated hatchery rainbow trout.[6] In 1998, Central California Coast steelhead were listed as threatened under the federal Endangered Species Act (ESA), and recent reports indicate that they are at high risk of extirpation on these creeks, with no successful adult steelhead spawning in Stevens Creek in 2014, 2015, and 2016[7] and evidence of only a tiny remnant population of steelhead persisting but

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5 As discussed below, we disagree with the list of projects Valley Water has identified as completed in the DEIR, *see* Table 2.4-4.

6 Leitwein, M, Garza JC, Pearse DE., "Ancestry and adaptive evolution of anadromous, resident, and adfluvial rainbow trout (Oncorhynchus mykiss) in the San Francisco bay area: application of adaptive genomic variation to conservation in a highly impacted landscape," Evolutionary Applications 10(1); 56-67 (2017), *available at* https://onlinelibrary.wiley.com/doi/10.1111/eva.12416 (last accessed Oct. 15, 2021).

7 Leicester, M. and Smith, J. 2016. Stevens Creek Environmental Conditions and Fish Resources in 2016.

in danger of extirpation on Coyote Creek.[8] Similarly, Chinook salmon persist in very low numbers, as evidenced by the considerable efforts of South Bay Clean Creeks Coalition to mobilize dozens of volunteers over the years to document Chinook redds in these creeks.[9]

Based on our review, the DEIR does not demonstrate the Proposed Project or the FAHCE-plus Alternative, the purported environmentally superior alternative, will be adequate to achieve the goals of restoring and maintaining these fish in good condition in accordance with the FAHCE Agreement and applicable law.

We recommend Valley Water engage the Adaptive Management Team (AMT), specifically the technical experts of the existing and proposed-to-be newly added AMT members, to complete the gaps in technical studies and refine the existing action alternatives (or develop a new action alternative) prior to issuing a supplemental and then final Environmental Impact Report (FEIR). Based on our experience on the Technical Work Group (TWG) in 2016-2017, we believe this technical work could be completed in a matter of months, as the TWG has already undertaken much of the foundational analysis. While we regret any further delay in implementation, we believe a collaborative technical effort now provides the best opportunity to develop an environmentally superior alternative that is supported by the record and likely to be approved by the jurisdictional agencies without opposition.

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8 Smith, J. 2018. Fish Population and Environmental Sampling in 2014-2018 on Coyote Creek.

9 *See* https://sbcleancreeks.com/spawning-map/SCU-Map.html (last accessed Oct. 15, 2021).

II.
COMMENTS

This section addresses our specific comments on the DEIR. We have organized the comments according to the headings in the DEIR for ease of reference.

Section 1.9 Organization of This Draft Environmental Impact Report

- *The DEIR should be shortened and simplified to permit clear understanding of the environmental consequences and comparative benefits of the Proposed Project and alternatives.*

CEQA documents should be clear and easy to understand: "EIRs shall be written in plain language and may use appropriate graphics so that decision makers and the public can rapidly understand the documents." 14 Cal. Code Regs § 15140. Further, EIRs should be concise: "the text of draft EIRS should normally be less than 150 pages and for proposals of unusual scope or complexity should normally be less than 300 pages." *Id.* at § 15141. The EIR should "effectively disclose to the public the 'analytic route the ... agency traveled from evidence to action.'"[10]

Section 1.9 of the DEIR provides an overview of the organization of the DEIR. While the overview is straightforward, the actual document is not. The DEIR is almost one thousand pages, with an additional one thousand pages of appendices. Discussion of environmental consequences of the Proposed Project and Alternatives is spread between DEIR Chapters 2 and 4 and the several appendices, making it difficult to compare the relative impacts of the action alternatives. Further, some critical data that should be presented or at least cross-referenced in the main document to support essential findings are only provided in the appendices. For example, it would be helpful for the main document to have a graphic directly comparing the quantitative

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[10] *Citizens of Goleta Valley v. Bd. of Supervisors*, 52 Cal. 3d 553, 568, 801 P.2d 1161 (1990) (internal citations omitted).

results of fish habitat availability under the No Project Alternative, Proposed Project, and alternatives.

In the course of supplementing the environmental analysis as requested below, we request that Valley Water also make the EIR easier to follow by shortening detailed discussion of resources that are not likely to be affected or are not controversial from the main document, adding summaries of data found in the appendices that are material to the DEIR's key findings, and consolidating the discussion of the environmental consequences of the Proposed Project versus alternatives.

Chapter 2. Project Description

- *The DEIR should provide a complete project description.*

The EIR must include a complete and accurate description of the project to permit a thorough evaluation of the environmental impacts, mitigation measures, and alternatives.[11]

> "[A] project description that gives conflicting signals to decision makers and the public about the nature and scope of the project is fundamentally inadequate and misleading. [Citation.] 'Only through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefit against its environmental cost, consider mitigation measures, assess the advantage of terminating the proposal (i.e., the "no project" alternative), and weigh other alternatives in the balance.'" (*Citizens for a Sustainable Treasure Island v. City and County of San Francisco* (2014) 227 Cal.App.4th 1036, 1052, 174 Cal.Rptr.3d 363.).[12]

Currently, the description in the DEIR is incomplete and confusing, omitting elements like specific schedule and description of non-flow measures proposed for Phase 1. While we understand that Valley Water cannot specifically describe measures for the entire 40-year

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11 14 Cal. Code Regulations § 15124; *County of Inyo v. City of Los Angeles*, 71 Cal.App.3d 185, 192 (1977).

12 *City of Long Beach v. City of Los Angeles*, 19 Cal. App. 5th 465, 477, 228 Cal. Rptr. 3d 23, 34 (2018).

program and so anticipates additional environmental review may be required in subsequent phases, we do not understand why the DEIR does not contain specific description of all proposed Phase 1 measures and schedule.

Section 2.3 Project Objectives

- *The Project Objectives should be translated into measurable objectives.*

The project description in the EIR must include a "statement of the objectives sought by the proposed project."[13]

The DEIR cites Settlement Agreement section 6.2.2, "Overall Management Objectives," as the "underlying Project purpose." DEIR, p. 2-9. That section states:

> Implementation of the Agreement will restore and maintain healthy steelhead trout and salmon populations as appropriate to *each* of the Three Creeks, by providing (A) suitable spawning and rearing habitat within each watershed, and (B) adequate passage for adult steelhead trout and salmon to reach suitable spawning and rearing habitat and for out-migration of juveniles. (emphasis in original).

The DEIR also references the Settlement Parties' commitment under Section 6.2.1 "to a program of measures that will restore and maintain fisheries, wildlife, water quality and other beneficial uses of the Three Creeks in good condition."

We do not object to the DEIR's reliance on the FAHCE Agreement as the project purpose for CEQA analysis. However, it is important to note that the purpose of this process is not just to implement measures to benefit fish, but to amend Valley Water's water rights to bring its water supply facilities and operations into compliance with applicable law.

Also, as discussed in more detail below, the overall management objectives are stated in qualitative terms in the FAHCE Agreement. For purposes of developing the adaptive

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13 14 Cal. Code Regulations § 15124(b).

management program and restoring salmon and steelhead, these objectives must be translated into measurable objectives (i.e., quantitative metrics) and related to population goals, as described in the Minimum Viable Population Analysis (*see* Merz Report, Attachment 1.1) and discussed below.

- *The DEIR should clarify Valley Water's proposed budget accounting methodology in light of the passage of time and Valley Water's early implementation of some measures.*

The DEIR (p. 2-9) refers to the budget established in the FAHCE Agreement: "Project objectives 1 and 2 were established in the FAHCE Settlement Agreement and are subject to funding obligations and limitations specified in Settlement Agreement Article VIII, Appendices C and D." Article VIII of the FAHCE Agreement specifically provides that "a maximum of $42 million will be made available by [Valley Water] in each of the Phases One, Two and Three in accordance with the agreed-upon cost accounting methodology."

As stated above, the FAHCE Agreement anticipated that it would become effective and implementation would begin in 2005. Instead, 18 years have passed since the FAHCE Agreement was initialed, environmental review under CEQA is still not complete, and the DEIR does not provide a proposed schedule for securing all necessary authorizations and implementation. The value of Valley Water's funding commitment to mitigate the impacts of its water supply operations has diminished with time. Valley Water should provide a proposal for how it intends to increase the original $42 million budget for Phases 1, 2, and 3 to compensate for inflation and the passage of time. Further, this settlement budget cannot constrain the State Water Board and other regulatory agencies in determining the measures necessary for compliance with appliable law.

In addition, Valley Water should identify the costs of any early implementation projects it intends to deduct from the Phase 1 budget. We previously disputed whether certain early implementation projects should be deducted from the FAHCE budget. This issue remains unresolved. We understand some projects may have been implemented as mitigation for other actions and so should not be deducted from the FAHCE budget, others have been implemented unilaterally by SCVWD without vetting by the Initialing Parties, and still others have not been completed in accordance with the FAHCE Agreement.

<u>Section 2.4. Project Components – Fish Habitat Restoration Plan Phase 1</u>

- *The Fish Habitat Restoration Plan (FHRP) does not provide a clear schedule or description of non-flow measures.*

A clear and complete project description, including a "general description of the project's technical, economic, and environmental characteristics," is critical to environmental analysis.[14]

According to the DEIR, the Proposed Project will have four phases. It describes Phase 1 as

> constitut[ing] those measures that would be implemented as part of the Proposed project through the [Fish Habitat Restoration Plan (FHRP)], includ[ing] the following three elements common to the Stevens Creek and Guadalupe River watersheds …:
>
> - reservoir re-operation rule curves for five reservoirs (project-level analysis)
> - fish passage barrier remediation for remaining barriers (programmatic-level analysis)
> - spawning and rearing habitat improvements (programmatic-level analysis)

However, the DEIR does not provide a clear description of the schedule for implementing flow and non-flow measures even for the immediate Phase 1. For example, it is not clear when or

[14] 14 Cal. Code Regs. § 15124(c).

even if the flow measures will be fully implemented during Phase 1 due to dam safety operations restrictions on Almaden, Calero, and Guadalupe reservoirs that "reduce reservoir storage capacities …." DEIR, p. 2-12. The DEIR states that implementation of the reservoir re-operation rule curves "would be limited to flow release levels that correspond to the interim restricted capacity of each facility … until each retrofit project is completed." *Id.* However, the DEIR does not provide any schedule for the seismic retrofit project, and instead states: "[t]hese projects are currently being defined, and each will undergo separate environmental review under CEQA. The timeframe for engineering, environmental review, and implementation of each of these projects is uncertain and will be staggered." *Id*. Based on our review of the description, we are unable to determine whether the reservoir re-operation rule curves are likely to be fully implemented during Phase 1.

Further, it is not clear what the proposed non-flow measures are or when they would be implemented. Table 2.4-4, "Remaining Fish Passage Barriers Identified in Settlement Agreement and Included in Fish Habitat Restoration Plan for Implementation," lists barriers we understand Valley Water proposes to remove during Phase 1. However, the DEIR reports that "[s]pecific plans and designs to address [remaining physical barriers to passage] have not yet been developed." *Id.* at 2-20. The DEIR does not explain why Valley Water has not been able to develop even preliminary plans and designs in the 18 years since the FAHCE Agreement was initialed. The DEIR does not include descriptions of the types of non-flow spawning and rearing habitat improvements (the third element from above) nor even approximate locations for such actions. As such, there is insufficient information to determine the likely impacts, positive or negative, of such actions or if they would represent cost effective uses of the Phase 1 budget allocation.

In addition, the list in Table 2.4-4 appears incomplete as it does not include barriers identified in the FAHCE Agreement that have not been effectively remediated to date. For example, Valley Water constructed the Evelyn Bridge fish ladder on Stevens Creek in 2015, but we understand from the resource agencies that the ladder is not fully functional and does not provide effective fish passage. Another example is the Alamitos Diversion Dam and Alamitos Reservoir. The South Bay Clean Creeks Coalition's maps of Chinook salmon redds report almost no redds or carcasses above this dam indicating it continues to be a barrier to fish passage.

Section 2.4.2.2 of the DEIR ostensibly describes proposed spawning and rearing habitat improvements, but again does not actually describe any specific projects to be implemented on a certain schedule. The DEIR states that, "[o]ngoing evaluation of the impacts on instream habitat associated with implementation of the reservoir re-operation rule curves, along with monitoring efforts, would allow Valley Water to identify site-specific measures, locations, and timing for future spawning and rearing habitat improvements." DEIR, p. 2-24. We disagree that identification of habitat improvement measures should be deferred to post-CEQA review or permitting. Rather, proposed non-flow measures should be described and analyzed concurrently with flow measures because they are intrinsically linked. The effectiveness of flow measures to provide suitable habitat depends in large part on the condition of the instream channel, which the non-flow measures are intended to improve.

As described below, we request that Valley Water, in consultation with the technical representatives of existing and proposed-to-be added AMT members, develop measurable objectives based on an analysis of minimum viable populations for salmon and/or steelhead on the Two Creeks. For example, the project description should include a measurable objective based on how much habitat is needed to support Chinook salmon returning to the Guadalupe River in the fall to spawn. Non-flow measures can then be designed, prioritized, and evaluated in conjunction with flow measures in specific locations to determine whether they are likely to achieve the measurable objective.

We request that Valley Water provide an "appropriate graphic" (e.g., Gantt Chart), *see* 14 Cal. Code. Regs. § 15140, that illustrates the proposed schedule of all Phase 1 measures and directly related projects such as seismic retrofit projects. We also request that Valley Water revise the description of already completed projects in consultation with the jurisdictional fish agencies to exclude those projects that are not functional or have not been completed in accordance with the FAHCE Agreement.

Section 2.4.2.4 Completion of an Advanced Recycled and Other Urban Water Plan in Coordination with City of San José

- *The Proposed Project should be updated to include a recycled water plan.*

The DEIR states that Phase 1 would also include development of a plan for "future water use options" that would include recycled water. DEIR, p. 2-26. Valley Water has not developed a draft plan for consideration in the DEIR in the intervening 18 years since the FAHCE Agreement was initialed.

In August 2021, Sherwood Design Engineers issued a Feasibility Study entitled, "Rewilding the Guadalupe River in San José" (Rewilding San José), which "identif[ies] strategies to help protect and transform the Guadalupe River into a place that support natural ecology, improves the human experience and public health of residents and increases the sustainability and resilience of the city."[15] It also provides information on the "importance of implementing integrated stormwater management and green infrastructure into the urban fabric," and identifies strategies for augmenting water supplies to "improve water quality and water levels and support ecosystem vitality along the Guadalupe River."[16] It identifies strategies for capturing stormwater runoff that can then be used to recharge local groundwater, and developing recycled water and nuisance groundwater to augment flow volume in the dry season.[17] For example, it describes Sewer Mining & Point-of-Use Recycling:

> …One alternative is sewer mining and point-of-use water recycling, in which municipal wastewater is extracted from a sewer line and treated on-site to meet a range of local needs for non-potable demands. Consistent with some regional long term water infrastructure plans, such "satellite" plants can provide an effective strategy for combating water scarcity and help optimize the watershed. This has been successfully done as pilot projects in other watershed, notably in the Pacific Northwest, and requires advanced treatment.[18]

Valley Water should work with partners including the City of San José, SPUR, and the undersigned to develop a plan to study the feasibility of different strategies for using stormwater runoff, recycled water, and nuisance groundwater that would directly or indirectly augment flows in the Three Creeks, building on the work done for the Rewilding San José Feasibility Study. As shown in the graphic below, there is potential for integrating the existing recycled water system into the Proposed Project.[19] Development of the plan should not be deferred any longer,

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15 Rewilding San José, p. 4, *available at* https://www.spur.org/sites/default/files/2021-09/SPUR_Sherwood_Rewilding_the_Guadalupe_River.pdf (last accessed Oct. 15, 2021).

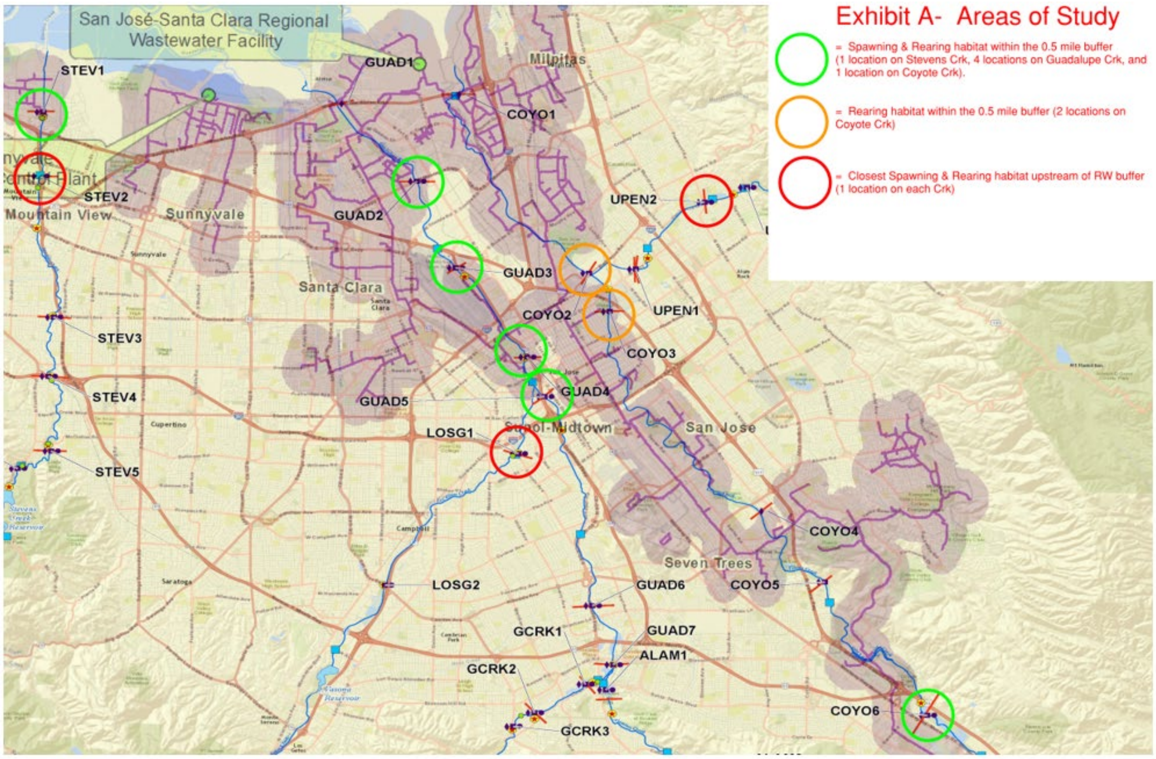
16 *Id.* at 4, 22.

17 *Id.* at 29-30.

18 *Id.* at 30.

19 Sherwood Design Engineers, "Creek Flow Augmentation Feasibility Study" (May 20, 2018), Exhibit A, "Limit of Work."

especially given that the DEIR anticipates less water will be available for fishery releases for the next decade or longer due to safety restrictions on Valley Water's reservoirs.



Section 2.6 Adaptive Management Program

- *The proposed Adaptive Management Program should be revised to include measurable objectives, adequate monitoring, clear criteria for future management decisions, and additional stakeholders.*

The FHRP includes an AMP based on Section 7 of the FAHCE Agreement.[20] That section provides in part:

> [I]n consultation with the [Adaptive Management Team], [Valley Water] will develop and thereafter implement an Adaptive Management Program. The purpose of the Adaptive Management Program is to maximize biological and physical benefits material to the Overall Management Objectives through the choice and implementation of the most cost-effective flow and non-flow measures.… The program will include:

[20] DEIR, p. 2-37.

(A) Measurable objectives consistent with the Phase One, Two, and Three management objectives for the steelhead trout and salmon fisheries and their habitats in the watersheds subject to the Agreement. The measurable objectives will relate to those habitat qualities impacted by [Valley Water's] facilities and operations, given the Parties' recognition that [Valley Water] is not responsible under this Agreement for other environmental conditions that may limit the population or distribution of these fisheries.…

(B) Operation and maintenance procedures and performance standards for individual facilities to contribute to the achievement of such objectives.

(C) Systematic monitoring of fish populations and actual habitat conditions affected by the measures implemented under this Agreement, to determine whether the measures are contributing to achievement of the measurable objectives.…

(D) Modification of flow and non-flow measures and other requirements … as appropriate to remedy any continuing impairment of a beneficial use.

We address certain components of the AMP proposed in the FHRP below.

A. Measurable Objectives

The AMP includes the following management objectives taken directly from the FAHCE Agreement:

> [i]mplementation of the Agreement will restore and maintain healthy steelhead trout and Chinook salmon populations as appropriate to each of the Three Creeks (Coyote Creek, Guadalupe River, and Stevens Creek) by providing (A) suitable spawning and rearing habitat within each watershed, and (B) adequate passage for adult steelhead trout and salmon to reach suitable spawning and rearing habitat and for out-migration of juveniles.[21]

We continue to support these overall management objectives. However, as stated in FAHCE Agreement section 7.3(A), these are *overall management objectives*, which must be translated into *measurable objectives* for purposes of implementing the AMP.

[21] *Id.* at App. 1, p. 6-2 (quoting FAHCE Agreement § 6.2.2).

The Department of Interior has described the importance of measurable objectives to adaptive management:

> Objectives play a critical role in evaluating performance, reducing uncertainty, and improving management over time. Clear and agreed-upon objectives are needed from the outset, to guide decision making and measure progress. *To be useful, objectives should be specific, measurable within a recognizable time frame, and results-oriented* (Williams et al. 2007).[22]

Dr. Joe Merz further describes the development of measurable objectives as a key element of adaptive management:

> [Quantitative] metrics should be grounded in science and provide a clear technical basis for tracking progress toward management goals (Schulz and Nie 2012). Two types of metrics are particularly important:
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> (1) quantitative targets representing achievement of a management objective, and
>
> (2) interim indicators of progress, which can provide early warning of the need to adjust management strategies (Christian-Smith and Abhold 2015). These metrics may be designed as indicators of the health or sustainability of a resource.[23]

He states that defining what it means to restore and maintain fish in "good condition" should be done early in the development of the AMP:

> As part of the Adaptive Management Program, the first goal should be to identify what a population in "good condition" is in measurable terms. Then determine habitat needs to support that population, and then determine the habitat presently available. If the habitat presently available is insufficient to support the population, then develop a restoration plan to meet or exceed habitat needs. This activity is then incorporated into the adaptive management process [described in FAHCE Agreement section 7.3].[24]

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[22] Williams, B. K., and E. D. Brown, "Adaptive Management: The U.S. Department of the Interior Applications Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC" (2012), p. 13 (emphasis added).

[23] Merz Report, pp. 5-6.

[24] *Id.* at 6.

The requirement to maintain fish in "good condition" is found in California Fish and Game Code section 5937, which requires, "[t]he owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around, or through the dam, to keep in good condition any fish that may be planted or exist below the dam." However, the statute does not expressly define what constitutes "good condition." Instead, this term has been defined largely by fisheries experts, often in the context of legal proceedings. Dr. Merz notes that Dr. Peter Moyle's definition of good condition "has emerged as the most broad-based and applicable standard for assessing Section 5937's good condition component (Bork et al. 2011)." As summarized by Dr. Merz, Dr. Moyle has described three levels for understanding fish in good condition:

> when multiple fish species are present below a dam, maintaining fish in good condition requires three levels of fish health: individual, population, and community.…
>
> (1) At the individual level, a healthy individual should have a robust body conformation; should be relatively free of diseases, parasites, and lesions; should have reasonable growth rates for the region; and should respond in an appropriate manner to stimuli.
>
> (2) At the population level, Moyle's definition of good condition is … that the population is viable… [based on two indicators]: "The first was that extensive habitat should be available for all life history stages. The second was that all life history stages and their required habitats should have a broad enough distribution in the creek to sustain the species indefinitely."
>
> (3) … A fish community is in good health if it:
>
> (a) is dominated by co-evolved species,
> (b) has a predictable structure as indicated by limited niche overlap among the species and by multiple trophic levels,
> (c) is resilient in recovering from extreme events,
> (d) is persistent in species membership through time, and
> (e) is replicated geographically.[25]

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[25] *Id.* at 8-9.

Dr. Merz explains, "[t]his approach offers a scientific framework for assessing good condition when a historical approach may not be feasible or appropriate (Bork et al. 2011), such as [on the Three Creeks] …."[26] Accordingly, he recommends establishing measurable objectives in the form of minimum viable population estimates for Chinook salmon and steelhead, the two target species:

> fish management planning under [the FAHCE Agreement] should start with defining minimum viable population numbers (i.e., those that are at low extinction risk) for the two target species. This approach is conservative and protectionary, as it uses the lower end of "good condition" as the starting point. An alternative approach would be to develop population numbers based on the potential of the watershed, which represent the upper end of "good condition." …[R]egardless of the starting point for analysis purposes, "good condition" ultimately defines a viable fishery, not just a marginally self-sustaining population (Bork et al. 2011).[27]

Dr. Merz previously prepared an analysis of minimum viable populations for Chinook salmon and steelhead on the Three Creeks and the habitat needed to support the target number of individuals at each lifestage to achieve overall population goals. He estimated the minimum viable population for these creeks, "expressed as annual run size, would be 83 (50/0.2/3) for high extinction risk, and 833 for low extinction risk."[28] That means the FHRP should be designed to provide access to sufficient suitable habitat to support an annual run size of, or approaching, 833 fish on each creek.[29] In the alternative, if the analysis shows there is insufficient habitat potential

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[26] *Id.* at 9.

[27] *Id.* at 11.

[28] *Id.* at 12; Minimum Viable Population Analysis, p. 7.

[29] The 883 minimum viable population estimate is the number for a single, self-producing population and thus should apply to each creek unless it is demonstrated that there is a connection, i.e., sharing of genetic material, between the populations.

to support a minimum viable population of salmon or steelhead on one of the creeks, that should inform the FHRP and management decisions as well.

We provided these results to Valley Water in draft form in October 2018, but Valley Water did not specifically respond, and the results are not specifically addressed in the DEIR. The DEIR does not specifically dispute the information we provided or include any alternative population metrics or analysis. Instead, the FHRP generally states that Valley Water does not intend to use "population metrics as a measurable objective or the basis to determine overall program performance."[30] Valley Water argues that there are a number of "uncertainties [that] make it difficult to link population abundance to restoration measures." *Id.* at 6-5. We understand that there are limiting factors beyond Valley Water's control that make using population numbers inappropriate for assessing compliance with permit terms.[31] That is not what we are seeking. In other words, we are not arguing that Valley Water should be required to demonstrate annually that a minimum of 883 each of Chinook salmon and steelhead are present in each creek. Instead, we are advocating for measurable objectives based on habitat quantity needed to meet mutually agreed-upon population goals. To our knowledge this is the most scientifically sound way to design and administer the restoration program. Consistent with the FAHCE Agreement, Valley Water would be responsible for meeting measurable objectives related to the habitat needs of Chinook salmon and steelhead while they are present in the Three Creeks.

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30 DEIR, Att. 1, p. 6-5.

31 Section 7.3 of the FAHCE Agreement already states the AMT will consider limiting factors outside of Valley Water's "that affect achievement of the Overall Management Objectives."

Use of population-based metrics is consistent with ESA recovery objectives for steelhead.[32] The Final Coastal Multispecies Recovery Plan for Central California Coast Steelhead (2016) (Steelhead Recovery Plan), envisions restoring self-sustaining populations at low risk of extinction:

> [NMFS'] vision is to have restored freshwater and estuarine habitats that are supporting self-sustaining, well distributed and naturally spawning salmonid populations that provide ecological, cultural, social and economic benefits to the people of California. Recovery plan objectives are to:
>
> 1. Reduce the present or threatened destruction, modification, or curtailment of habitat or range;
> 2. Ameliorate utilization for commercial, recreational, scientific, or educational purposes;
> 3. Abate disease and predation;
> 4. Establish the adequacy of existing regulatory mechanisms for protecting CCC steelhead now and into the future (i.e., post-delisting);
> 5. Address other natural or manmade factors affecting the continued existence of CCC steelhead; and
> 6. *Ensure CCC steelhead status is at a low risk of extinction based on abundance, growth rate, spatial structure and diversity*.[33]

Thus, it appears this analysis will be useful and may be necessary for Valley Water to obtain incidental take authorization for steelhead under the ESA from NMFS.

We provide the Minimum Viable Population analysis again (*see* Merz Report, Attachment 1.1) and request that Valley Water supplement the EIR to address it. We request that

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32 Merz Report, pp. 10-11.

33 Steelhead Recovery Plan, p. 19 (emphasis added), *available at* https://media.fisheries.noaa.gov/dam-migration/2016-multispecies-recovery_plan-vol4.pdf (last accessed Oct. 15, 2021).

the AMP include measurable objectives designed to assess whether the measures in the FHRP are providing access to enough suitable habitat at the right times for the lifestages present in the Three Creeks to support minimum viable populations of Chinook salmon and steelhead in these creeks. Absent establishing measurable objectives on this basis, it is not clear how Valley Water, the permitting agencies, and the AMT will evaluate whether the FHRP has adequately contributed to restoration of fish to good condition or whether changes are needed, or make science-backed findings as to whether fish have been restored to good condition.

B. Monitoring

According to the DEIR, the "AMP monitoring program is designed to track progress toward achieving the measurable objectives and has been organized into three categories: compliance monitoring, validation monitoring and long-term trend monitoring."[34]

Under CEQA, monitoring is essential to ensuring that required mitigation measures are being implemented effectively. An agency "'shall provide that measures to mitigate or avoid significant effects on the environment are fully enforceable through permit conditions, agreements, or other measures' ([Cal. Pub. Resources Code] § 21081.6, subd. (b)) and *must adopt a monitoring program to ensure that the mitigation measures are implemented*" ([*id.* at] § 21081.6, subd. (a)).[35]

Thus, the monitoring program should not be treated as discretionary, rather it will be a critical element of adaptive management and likely a requirement of regulatory permits under the

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[34] DEIR, p. 2-41.

[35] *Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal. App. 4th 1252, 1260–61 (2000) (emphasis added).

California Water Code and federal ESA. As stated above, the validation and long-term trend monitoring should produce results that allow Valley Water and interested parties to evaluate whether the FHRP is contributing to achievement of measurable objectives for habitat that will support minimum viable populations of Chinook salmon and steelhead on the Three Creeks and, if not, provide a basis for adaptive management decisionmaking.

Valley Water's proposed monitoring in the Two Creeks, as presented in the DEIR, is insufficient to determine much more than seasonal presence/absence of some species and is not in line with established monitoring protocols in neighboring watersheds (e.g., Alameda Creek, San Mateo Creek, etc.). While other stakeholders have tried to fill gaps in SCVWD's existing monitoring by conducting juvenile salmonid presence and absence and adult spawner surveys (Dr. Jerry Smith and South Bay Clean Creeks Coalition, respectively), there is insufficient information collected through these programs to understand population dynamics or support adaptive management.

Future fisheries monitoring should include at least some of the cost effective, common fisheries surveys conducted by dam operators in neighboring watersheds, including: regular habitat typing, benthic macroinvertebrate sampling, streamflow measurements at riffle crests in key migration locations, rotary screw trap or other juvenile outmigration survey tools, electrofishing with CDFW-approved protocols, robust spawner surveys, and Passive Integrated Transponder (PIT) tagging studies to understand seasonal movements and habitat usage of fish of interest. Collection of otolith or tissue samples from salmonid carcasses should also be a goal of future surveys to provide information on the origins and spawning success of steelhead and Chinook salmon in the Two Creeks and neighboring watersheds.

C. Implementing Additional Measures

According to the DEIR, "[a]t the end of each phase, the AMT would evaluate the effectiveness and performance of implemented Settlement Agreement measures and determine whether Additional Measures … are needed."[36] The DEIR does not identify specific Additional Measures, and instead states, "Phase 2 and Phase 3 Additional Measures are uncertain at this juncture."[37] It does propose specific criteria for when implementation of Additional Measures would be considered:

> Pursuant to Settlement Agreement Section 6.1.2, Valley Water would identify and implement Additional Measures only if all three of the following criteria are met:
>
> - Overall management objectives for the preceding phase have not been met. This would be determined at the end of the 10-year monitoring period for the preceding phase.
> - The proposed measures are deemed feasible under CEQA and NEPA.
> - The proposed measures are determined to be cost-effective during implementation of the AMP.[38]

As stated above, the need for additional measures should be based on whether implemented measures have meaningfully contributed to achievement of the measurable objectives. Failing to articulate an objective basis for making those determinations is likely to lead to unattained goals and disputes.

Valley Water should clarify how it proposes to evaluate the need for additional measures after 10 years given the uncertain timeline for implementation of Phase 1, including whether it will be possible to fully implement new reservoir rule curves while there are safety restrictions

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36 DEIR, p. 2-40.

37 *Id.*

38 *Id.*

on reservoirs located on the Two Creeks. We are concerned that Valley Water may rely on the inability to implement flow measures during the first 10 years as a basis for deferring implementation of additional measures, which will further contribute to potential extirpation of Chinook salmon and steelhead on the Two Creeks. We request Valley Water describe the process it proposes to follow for development and approval of additional measures to be implemented during Phases 2 and 3, if necessary, so the procedures can be reviewed and approved by the State Water Board's Division of Water Rights and other permitting agencies as appropriate.

D. Adaptive Management Team

Section 7.2 of the FAHCE Agreement describes certain procedures for development of the AMP, including the convening and membership of the AMT: "SCVWD and the other Parties will form an Adaptive Management Team (AMT). The AMT will comprise a single representative from each Party. Membership in this team may be open to other interested persons, with the consent of SCVWD and the other Parties."

The DEIR modifies this term, instead limiting membership to "a representative from Valley Water, CDFW, USFWS, NMFS, and one representative of the NGOs (for example, Trout Unlimited, Pacific Coast Federation of Fishermen's Associations, and California Trout)."[39] Trout Unlimited, PCFFA, Northern California Council of Fly Fishers International, and California Trout are all parties to the FAHCE Agreement and, as such, a representative from each is entitled to participate in the AMT.

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[39] DEIR, p. 2-38.

In addition, the proposed AMT membership omits several important stakeholders, but the FAHCE Agreement anticipates the inclusion of additional stakeholders. We recommend that the AMT convene to consider whether there are additional entities that should be represented on the AMT, such as the San Francisco Regional Water Quality Control Board, City of San José, GCRCD, County of Santa Clara, Native American Tribes, and others as soon as possible and before major decisions regarding the AMP are made and the EIR is finalized.

According to the U.S. Environmental Protection Agency (EPA), broad stakeholder engagement is important to watershed planning and management: "Clearly, engaging and involving stakeholders benefits both regulatory and non-regulatory actions to restore and protect America's waters. Synthesizing perspectives, policies, priorities and resources through a watershed approach blends science, technology and statutory responsibilities with social, economic and cultural considerations."[40] EPA further recommends stakeholder engagement throughout any watershed planning processes:

> The stakeholder group needs to be involved at each stage of the watershed planning process. Their knowledge of local social, economic, political and ecological conditions provides the yardstick against which proposed solutions must be measured. Also, the goals, problems and remediation strategies generated by stakeholders clarify what's desirable and achievable.[41]

We are also concerned that limiting the AMT to a single representative will impede its work. At a minimum, each member should have a primary representative and an alternative; although, we recommend that each member be allowed to determine their representatives, within

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[40] EPA, "Engaging Stakeholders in Your Watershed: (2d Edition May 2013), *available at* https://cfpub.epa.gov/npstbx/files/stakeholderguide.pdf (last accessed Oct. 15, 2021), p. 9.

[41] *Id.* at 10.

reason. For example, it will be necessary for efficient administration of the AMP for the primary representative and technical experts from AMT member organizations to have the opportunity to participate in AMT meetings.

Further, the AMP should permit the AMT to meet as needed, with one annual meeting being the minimum. Flow and habitat conditions can change significantly within a single water year and may necessitate timelier AMT attention for adequate response.

<u>Section 2.8.1 Proposed Project Implementation Schedule</u>

- *The DEIR should clearly state the proposed implementation schedule for the Proposed Project and action alternatives.*

The DEIR describes four phases of the FHRP: "Phases 1 through 3 are proposed at a 10-year duration for each phase. Phase 4 is proposed to be ongoing starting from year 31 after the effective date."[42] It states that Valley Water must complete environmental analysis and obtain necessary authorizations under state and federal law before the FAHCE Agreement goes into effect.[43]

As stated above, implementation schedule is a critical part of the project description that is missing from the DEIR. We request that Valley Water provide a GANTT chart or other appropriate graphic showing the anticipated implementation of the Proposed Project, and an overlay or separate chart that places the Proposed Project schedule into the context of any other directly related projects, like seismic retrofits and anticipated start dates of flow and non-flow measures in the Two Creeks.

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42 DEIR, p. 2-51.

43 *Id.* at 2-52.

Section 3.1.2 Baseline

- *The methodology for analyzing the present and future baselines should be clarified.*

The EIR "must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published."[44] "Knowledge of the regional setting is critical to the assessment of environmental impacts. Special emphasis should be placed on environmental resources that are rare or unique to that region and would be affected by the project."[45]

An accurate description of the baseline condition of the fisheries is important to the environmental analysis. As stated above, the steelhead and Chinook salmon fisheries are imperiled within the Three Creeks and within the region; although, unlike steelhead, Chinook salmon are not listed under the ESA. At the time the FAHCE Agreement was initialed, there was some disagreement as to whether Chinook salmon were native to these waters. We previously submitted evidence, including a report by the California Department of Fish and Game (now Department of Fish and Wildlife),[46] that the fish were native. We now submit the results of a new peer-reviewed study which provides the first physical evidence that Chinook salmon were historically native to the Guadalupe River watershed, the southernmost major metropolitan area hosting salmon runs in the United States."[47] Regardless, the FAHCE Agreement commits to

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44 14 Cal. Code of Regulations § 15125(a).

45 *Id.* at § 15125(c).

46 John E. Skinner, California Department of Fish and Game, *An Historical Review of the Fish and Wildlife Resources of the San Francisco Bay Area* (1962) (FAHCE Complaint, Exhibit 5).

47 Lanman RB et al., "Ancient DNA Sequencing Provides Proof of Historic Chinook in Guadalupe River Ancient DNA Sequencing Provides Proof of Historic Chinook in Guadalupe River," PLoS One 16(4); e0244470. More specifically:

restore both the steelhead and Chinook salmon fisheries to these waters. Further, Valley Water's obligations under the Fish and Game[13] and Water Codes[14] are not limited to the protection of native fisheries. To the extent the discussion in the EIR disputes that the Chinook salmon are historically native to these waterways, it should delete that incorrect information and summarize the evidence that shows they are to make use of the best available science at the time of publication of the DEIR, which has evolved since the FAHCE Agreement was initialed. It is reasonable for the EIR to discuss genetics studies over the last three decades that identify most contemporary Chinook salmon as Central Valley Fall-run Chinook salmon DPS, but this should also mention that two genetics studies have also identified the presence of modest numbers of salmon in the Guadalupe River that are California Coast Chinook salmon Evolutionary Significant Unit (ESU), which are federally threatened.[48]

The DEIR analyzes the proposal according to two baselines, that is conditions as they were in 2015 with reservoir storage restrictions in place, and conditions as they are predicted to

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> This study provides the first physical evidence that adult Chinook salmon spawned in any San Francisco Bay tributary watershed historically and extends their nativity to a coastal watershed further south than previously recognized. These results contrast with a paucity of archaeological, historical observer, and museum records. Ancient DNA sequencing of other archaeology specimens may refine our understanding of the historical range of other species. Whether today's Guadalupe River salmon are hatchery strays or not is moot. As stated above, there is evidence that the recent Guadalupe River population has had at least some genetic introgression from Russian River and Columbia River stocks. If this watershed is managed to enable a self-sustaining coastal Chinook population at the very southern border of its range, these fish may represent an important genetic reservoir of fish buffered against changing climatic conditions, such as global warming, and may potentially counter the collapsing diversity extant in this salmon species.

Id. (internal citations omitted).

[48] Nielsen, Jennifer L., "Salmon from the Sacramento-San Joaquin Basin and Guadalupe River 1992–1994. California Dept. of Fish and Game, Anadromous Fisheries Division, Sacramento; Report No.: CDFG Technical Report FG 2081 IF (1999); Garza, John Carlos, Pearse, Devon. Population genetics of Oncorhynchus mykiss in the Santa Clara Valley Region. Final Report to SCVWD (2008), *available at* https://swfsc-publications.fisheries.noaa.gov/publications/CR/2008/2008Garza2.pdf (last accessed Oct. 15, 2021).

be in 2035, when reservoir storage restrictions are expected to be lifted and demand increased.[49] We do not object in principle to the consideration of two baselines; however, we are concerned that the modeling results presented to not provide an accurate picture of conditions under either baseline. For example, it is not clear that the modeling of the 2035 baseline adequately accounts for anticipated changes in hydrology-related climate change.

It is important that the model produce reliable results under both baselines, but as discussed above, the DEIR does not show that Valley Water is performing adequate fisheries monitoring or has otherwise obtained accurate baseline information to determine relationships between habitat, water and fish populations. We understand the same modeling approach used in the DEIR was used by SCVWD for the Anderson Dam Seismic Retrofit Project pending before the Federal Energy Regulatory Commission (FERC). However, NMFS determined the approach was incomplete and contained errors and requested a change in methodologies and updated results. It appears flaws identified in the modeling of Coyote Creek are also present in the modeling for the Guadalupe River and Stevens Creek. We request Valley Water engage technical representatives of the AMT to correct any deficiencies in the modeled relationships between streamflow and habitat. Assuming Valley Water has bathymetry and detailed streamflow measurements for all its watersheds, developing flow to available habitat scenarios using existing bathymetry data and IFIM, PHABSIM, or 2D modeling would be a straightforward exercise that would inform an accurate portrayal of baseline conditions. We also request that Valley Water consider additional fisheries monitoring to document existing baseline conditions.

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[49] DEIR, pp. 3-1 – 3-2.

Chapter 4 Alternatives

- *The DEIR does not demonstrate consideration of a reasonable range of feasible alternatives.*

The EIR "must consider a reasonable range of potentially feasible alternatives that will foster informed decisionmaking and public participation."[50] "One of [an EIR's] major functions ... is to ensure that *all reasonable alternatives* to proposed projects are thoroughly assessed by the responsible official."[51] The discussion of alternatives must "include sufficient information about each alternative to allow evaluation, analysis, and comparison with the proposed project."[52] "Under the 'rule of reason,' an EIR's discussion of alternatives is adequate if it provides sufficient information to compare the project with a reasonable choice of alternatives."[53]

The DEIR identifies only one serious action alternative, the FAHCE-plus Alternative, to the Proposed Project. Those alternatives are very similar. The flow measures are essentially the same but for some variation in proposed pulse flows, and the non-specific non-flow measures are the same. As discussed below, the DEIR indicates that the benefits and impacts are almost identical, but finds the FAHCE-plus Alternative is environmentally superior because it would provide a greater number of passage days. However, based on our review, the finding of additional passage days is not supported by the data in the DEIR and appendices. Given that the

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[50] 14 Cal. Code of Regulations § 15126.6(a).

[51] *Citizens of Goleta Valley v. Bd. of Supervisors*, 52 Cal. 3d 553, 565 (1990) (emphasis in original; internal citations omitted). "An EIR need not consider every conceivable alternative but must consider a range of alternatives sufficient to permit the agency to evaluate the project and make an informed decision, and to meaningfully inform the public." *Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal. App. 4th at 1264.

[52] 14 Cal. Code of Regulations § 15126.6(d).

[53] *Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal. App. 4th at 1264.

Proposed Project and FAHCE-plus Alternative are almost identical, and both are incomplete with regard to specific non-flow measures, the DEIR does not demonstrate consideration of a reasonable range of feasible alternatives.

We request that Valley Water work with technical representatives of the AMT to develop additional alternatives for consideration that include specific flow and non-flow measures, at least for Phase 1.

<u>Section 4.2.3 Scenario 4 Alternative Reservoir Re-operation Rules</u>

- *The DEIR does not show adequate consideration of Scenario 4.*

The DEIR describes Valley Water's consideration and elimination of "Scenario 4," a set of alternative rule curves developed by members of the TWG. As described in the DEIR, Scenario 4 was intended "to increase passage opportunities for migrating adult steelhead and Chinook salmon based on the historical frequency of suitable storm events while also providing for sufficient reservoir releases throughout the year to provide passage and habitat for other fish lifestages."[54] However, it does not appear Valley Water accurately characterized Scenario 4 for purposes of modeling and eliminated it from further consideration based on the model results.[55]

Scenario 4 was intended to result in an alternative that combined flow and non-flow measures to optimize the benefits of reservoir releases and reduced potential conflicts between fisheries and water supply.[56] It articulated a fisheries-based logic path that could be used to

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[54] DEIR, p. 4-7.

[55] *Id.*

[56] *See Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal. App. 4th at 1264 ("The discussion should focus on alternatives that could substantially reduce or avoid one or more of the significant environmental effects while still serving the project's fundamental objectives.").

collaboratively develop an environmentally superior alternative that was likely to achieve the fish restoration goals without adversely impacting reliable water supply. We anticipated an iterative process for refining Scenario 4 that would also help determine whether there was even water available to support each lifestage for the minimum viable population estimate and to optimize flow releases for multiple benefits. However, Valley Water ran the scenario without the participation of the TWG, and there was no attempt to refine Valley Water's characterization of the "rules" under Scenario 4 to optimize available water based on iterative model runs, as we had intended.

As stated above, we recommend Valley Water convene technical representatives of the AMT, to complete analysis of Scenario 4 and other gaps in the alternatives analysis.

Section 4.20 Environmentally Superior Alternative

- *The DEIR does not show the FAHCE-plus Alternative is environmentally superior.*

As discussed above, the DEIR finds that the Proposed Project and FAHCE-plus Alternative would achieve the project objectives and would have similar impacts, but the FAHCE-plus Alternative provides greater benefits to steelhead, making it the environmentally superior alternative:

> Based on this analysis, while the Proposed Project and FAHCE-plus Alternative achieve the Project objectives and requirements of the Settlement Agreement and have similar levels of impact significance after the implementation of mitigation, the FAHCE-plus Alternative is the environmentally superior alternative because it has the greatest benefits to steelhead habitat conditions and migration potential.[57]

[57] DEIR, p. 4-242.

These findings, that the Proposed Project and FAHCE-plus Alternative will achieve the project objectives and requirements of the FAHCE Agreement and that the FAHCE-plus Alternative is environmentally superior alternative, do not appear supported by substantial evidence in the DEIR.

The scientific methodologies used in preparing the analysis on which these findings are based are not clearly articulated. For example, after compiling days of passage information provided in different sections of the DEIR, we found that the Proposed Project appears to provide the most days of passage to different life stages of salmon and steelhead, not, as the DEIR claims, the FAHCE-plus Alternative.

Further, SCVWD's reliance on averaging flow across broad habitat areas for modeling purposes, rather than use of empirical data from the Two Creeks, renders its analyses unreliable without further justification. The detailed methodology for calculating streamflow and habitat relationships, and the data and assumptions that went into those calculations, must be included in the DEIR and its appendices to determine which alternative is environmentally superior. Without this information, no case can be made for any of the alternatives as the environmentally superior option.

Also, the DEIR's use of percent changes in "available habitat" is not sufficient to demonstrate the Project or alternatives will achieve restoration goals:

> The DEIR mentions "Available Habitat" 12 times, but "available habitat" is not articulated in measurable terms other than comparisons of percent change; not in relationship to supporting "good condition". In other words, if performance comparisons indicate an action would increase habitat by 100%, that could be a shift from 1 acre to 2 acres or 50 acres to 100 acres of available habitat. Percent is, therefore, relevant to

> present available habitat but not necessarily to meeting the needs of a low-extinction population.[58]

The analyses in the DEIR essentially find that the Proposed Project and FAHCE-plus Alternative will both improve conditions for salmon and steelhead. However, marginal enhancements over baseline do not represent an environmentally superior alternative.

Section 5.5.2 Projects, Plans, and Programs Considered in the Cumulative Impact Analysis

Under CEQA, the EIR must describe, in detail, the significant effects on the environment of the project, including cumulative effects.[59] The purpose of the cumulative impacts analysis, specifically, is to prevent the environmental harm that could result from the piecemeal approval of several projects with related impacts.[60] The EIR must focus on the collective impact of the proposed project and other projects on the affected resources, not just the proposed project's relative effects to the overall problem.[61]

The DEIR includes an expansive list of related projects and activities. *See* DEIR, p. 5-5 – 5-14, "Table 5.5-1. Probable Future Projects, Programs, and Plans." However, based on our review, the DEIR does not evaluate how those related projects and activities will interact with the Proposed Project and alternatives to cumulatively affect the fisheries and other beneficial uses of the Two Creeks, or proposed measures to avoid, minimize, or mitigate any adverse cumulative impacts.

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[58] Merz Report, p. 13.

[59] 14 Cal. Code Regs. §§ 15355, 15358; City of San Diego v. Board of Trustees of Cal. State University, 135 Cal.Rptr.3d 495, 507 (Cal. Ct. App. 2012).

[60] *Las Virgenes Homeowners Fed'n v. County of Los Angeles*, 177Cal.App.3d 300, 306 (Cal. Ct. App. 1986).

[61] *Kings County Farm Bureau v. City of Hanford*, 221 Cal.App.3d 692, 721 (Cal. Ct. App. 1990).

<u>Section 5.6 Cumulative Impact Analysis</u>

- *The DEIR does not adequately analyze the cumulative impacts of the Proposed Project or Action Alternatives.*

As stated above, the DEIR lists but does not adequately disclose or analyze the cumulative impacts of the Proposed Project and related activities and projects on fisheries and other beneficial uses of the Two Creeks. For example, the DEIR lists the "Encampment Clean Up Program," but does not analyze how homeless encampments on the Three Creeks may cumulatively affect beneficial uses of the waterways or affect achievement of the FAHCE overall management objectives.

Further, it does not appear that the DEIR adequately analyzes the impacts of the Proposed Project and alternatives under predicted conditions associated with climate change. "Climate change (global warming) is an increasing problem for salmonids because they are basically coldwater fishes living in a waterscape that is becoming warmer, with more variable flows in streams."[62] However, these fish have adapted to changing climatic conditions in the past and can do so again if actions are taken to promote these fisheries' resilience to change, such as providing access to suitable habitat:

> Salmon, steelhead, and trout have adapted to a wide variety of climatic conditions in the past, and could likely survive anthropogenic shifts in climate in the absence of other anthropogenic stressors (Moyle et al. 2013). Yet, today, most salmonid species in California are less resilient than they once were. Improving resiliency requires an improvement in salmonid life history diversity. Salmonids have responded and adapted to environmental change for more than 50 million years due to variation in their life histories and behavior. Much of this variability is tied to differences in the timing of freshwater and ocean migrations. These timing differences contribute to life history diversity which, in turn, promotes species resilience to change. Over the last century, life history and behavioral diversity has been greatly diminished due to changes in habitat,

62 State of Salmonids, p. 11.

> discontinuity between habitats, genetic homogenization, and interactions with nonnative species. The relatively recent reduction in salmonid life history and behavioral diversity means that salmonids are less able to adapt to a rapidly changing California. Access to diverse and productive habitats, and reductions in interactions between hatchery and wild salmonids, are fundamental to restoring salmonid resilience throughout California. Many of the historically productive and diverse habitats used by salmonids are either blocked behind dams and levees or are significantly altered and no longer function properly. Restoring such habitats and access to them is of paramount importance. In short, if native salmon, trout, and other coldwater fishes are going to continue to be part of California's natural heritage, it is essential to invest in productive and diverse habitats to promote salmonid resilience.[63]

The DEIR should analyze the impacts of the Proposed Project and alternatives on fisheries not just based on historical conditions, but also accounting for alterations in hydrology and other conditions attributable to climate change. Not only will the fishery impacts of the Proposed Project and alternatives be different under a warming climate, but the importance of implementing the FHRP to increase the resilience and long-term survival of Chinook salmon and steelhead on the Three Creeks will be heightened.

III.
REQUESTS FOR FURTHER PROCEDURES

We request that Valley Water supplement the EIR with additional technical analysis and by making other revisions to improve the clarity and conciseness of the discussion and findings, as described above and summarized below:

- Provide a complete project description, including description of proposed non-flow measures;
- Prepare a recycled water study plan so potential strategies can be evaluated in the EIR;
- Revise the AMP, consistent with recommendations made in the Merz Report and Minimum Viable Population Analysis, to include measurable objectives,

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63 *Id.* at 22.

monitoring adequate to demonstrate progress in meeting the measurable objectives, and clear criteria for future management decisions regarding Additional Measures;

- Convene the AMT to consider addition of key stakeholders;
- Provide an implementation schedule for the Proposed Project and alternatives;
- Clarify the methodology for analyzing impacts under the present and future baselines;
- Develop additional action alternatives in consultation with the technical representatives of the AMT;
- Revise or clarify the basis for finding the FAHCE-plus Alternative is the environmentally superior alternative;
- Supplement the cumulative impacts analysis.

While we believe Valley Water can complete the additional technical analysis quickly with the assistance of technical representatives of the AMT, we anticipate the need to circulate a supplemental EIR for public review and comment prior to issuing the final EIR.[64]

IV.
CONCLUSION

We thank Valley Water for achieving the significant milestone of publishing the DEIR that will support implementation of the FAHCE Agreement and amendment of Valley Water's water rights. While we are requesting some additional technical analysis, we recognize the

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[64] "When significant new information shows that the project will have a different or more severe effect on the environment, the agency must notify the public and recirculate the draft EIR for review and comment. (§ 21092.1; *Laurel Heights Improvement Assn. v. Regents of University of California* (1993) 6 Cal.4th 1112, 1129-1130 [26 Cal.Rptr.2d 231, 864 P.2d 502] (*Laurel Heights II*); Guidelines § 15088.5, subd. (a).)" *Fed'n of Hillside & Canyon Associations v. City of Los Angeles*, 83 Cal. App. 4th 1252, 1258, 100 Cal. Rptr. 2d 301 (2000); *see also See* Cal. Code Pub. Resources § 21166 (describing when a supplemental EIR must be prepared).

considerable work and resources Valley Water has put into preparing the DEIR, not least of all the significant modeling work done since 2017. We look forward to working with Valley Water and other stakeholders to supplement the EIR and ensure it is sufficient to disclose the environmental consequences of the Proposed Project and alternatives and provide the basis for selecting an environmentally superior alternative that can achieve the FAHCE overall management objectives of restoring and maintaining Chinook salmon and steelhead in good condition.

Sincerely,

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Attachment 1

Expert Report of Joseph E. Merz, Ph.D.

1. I am providing this report in support of Guadalupe-Coyote Resource Conservation District's (GCRCD) and California Trout, Inc.'s (CalTrout) comments on the Santa Clara Valley Water District's (Valley Water or SCVWD) Fish and Aquatic Habitat Collaborative Effort (FAHCE) Draft Program Environmental Impact Report (DEIR) (June 30, 2021).

2. I am the President and Principal Scientist for Cramer Fish Sciences.[1] I have more than 30 years of experience working for state, city, university, and public entities as a fisheries ecologist and performing studies and monitoring fish populations to protect and enhance their habitat. I have completed numerous assessments of habitat manipulation on aquatic resources, including habitat enhancement, flow manipulation, invasive species removal, and regulation implementation, particularly for Chinook salmon and steelhead. I also have extensive experience with habitat typing and delineation with the use of GIS and aerial maps, have designed multi-million-dollar projects to restore river channels and floodplains, and have trained numerous professionals in these techniques.

3. I reviewed the DEIR in preparing this report in addition to sources specifically cited in the text and listed in Section IV, *infra*.

4. My review of the DEIR focused on the technical adequacy of Valley Water's analysis of whether the Proposed Project (*see* DEIR, p. ES-3) versus alternatives (*id.* at ES-12 – ES-14) is likely to achieve the fish restoration goals described in the FAHCE Settlement Agreement (2003). In the DEIR, Valley Water offers predicted measurable changes to habitat

[1] *See* https://www.fishsciences.net/who-we-are/ (last accessed Oct. 14, 2021).

associated with the Proposed Project and alternatives. However, Valley Water has not clearly described the scientific methods it used in preparing the analysis and has not clearly articulated what the goals of the project are. Much of the analysis missing from the DEIR is provided in my report, "Fisheries and Aquatic Habitat Collaborative Effort: Population Criteria and Habitat Supply Model to Inform Fishery Management in the Three Creeks," initially provided to Valley Water in 2018 (Attachment 1.1).

5. This report is organized as follows: Section I describes the necessity of translating the goal of restoring fish to "good condition" into clear management goals and measurable objectives; Section II explains why the technical analysis in the DEIR is insufficient to show the Proposed Project or alternatives will restore fish to good condition; Section III recommends next steps for completing the necessary technical analysis; and Section IV lists literature cited.

I. THE FAHCE AGREEMENT'S OVERALL MANAGEMENT OBJECTIVES MUST BE TRANSLATED INTO SPECIFIC MANAGEMENT GOALS AND MEASURABLE OBJECTIVES.

6. The DEIR summarizes the FAHCE Agreement's objectives related to restoring and maintaining Chinook salmon and steelhead in Guadalupe River, Stevens Creek, and Coyote Creek:

> Objective 1: Restore and maintain a healthy steelhead population in the Stevens Creek watershed by providing *suitable* spawning and rearing habitat, adequate passage for upmigrating adults and outmigrating juvenile steelhead [(i.e., kelts)], and extended distribution of suitable habitat in Phases 2 and 3 as determined through the adaptive management program (AMP);
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> Objective 2: Restore and maintain healthy steelhead and Chinook salmon populations in the Guadalupe River watershed by providing *suitable* spawning and rearing habitat, adequate passage for upmigrating adults and outmigrating juvenile fish [(i.e., kelts)], and

> extended distribution of suitable habitat in Phases 2 and 3 as determined through the AMP ….[2]

7. “Suitable” on its own does not express measurable objectives for habitat that can be monitored or evaluated to gauge progress in achieving fish restoration. Stakeholders need to develop an express, verifiable understanding of what “suitable” means here. Articulating appropriate quantity and quality of habitat to support a viable population is critical to the ability of stakeholders to track success and implement adaptive management.

8. To support development of adequate objective statement(s), I provide both peer-reviewed language related to restoration ecology goals and definitions of “good condition” and “restoration” that have been used in legal and regulatory settings.

9. Goals are ideals or major accomplishments to be attained, whereas objectives are ***measurable targets*** that must be achieved to attain the goal (Barber and Taylor 1990; Tear et al. 2005). Both are important elements of identifying and prioritizing restoration actions, and both are influenced by stakeholder values.

10. In the context of river restoration planning, the importance of clearly stated goals is often overlooked, perhaps because conflicting stakeholder values and uncertain predictions of restoration outcomes make goal setting a difficult task (Beechie et al. 2008). Setting stream restoration goals involves considerable effort in gathering stakeholder opinions, negotiating restoration goals that most stakeholders can agree to, and specifying constraints imposed by conflicting socioeconomic goals (Stanford and Poole 1996; Hulse et al. 2004). Yet, this step is critical to successful stream management and restoration because it gives all parties a common

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[2] DEIR, ES-2 (emphasis added).

understanding of management targets and tradeoffs (Barber and Taylor 1990; Stanford and Poole 1996; Baker et al. 2004; Beechie et al. 2008).[3] Moreover, clearly stated goals guide restoration practitioners in choosing how to identify and prioritize restoration efforts and prevent drift in management objectives through time (Barber and Taylor 1990).

11. River restoration efforts typically focus on one of three goal types: restoration of

(1) species,

(2) ecosystems or landscapes, and

(3) ecosystem services (e.g., recreation, clean water, and fish production) (Parker 1997; Beechie and Bolton 1999; Ehrenfeld 2000).

12. While varying in complexity and purpose, each goal requires an understanding of how ecosystems have changed from their natural potential and what kinds of restoration are possible (Ebersole and Liss 1997). Thus, restoration goals should be stated in the context of landscape and aquatic processes that drive habitat degradation and species declines, as well as human constraints on recovery options (Frissell 1997; Slocombe 1998). Beechie et al. (2008)

[3] Research on collaborative watershed management has paid scant attention to role of grassroots stakeholders – the people that actually use natural resources. Lubell argues cooperation from grassroots stakeholders is necessary for the success of collaborative management and outlines three theoretical perspectives to explain cooperation. They tested these theoretical perspectives using a survey of farmer participation in the Suwannee River Partnership, Florida. The findings suggest farmers' perceptions of policy effectiveness are largely driven by economic considerations, whereas participation in collaborative management is linked to social capital. Bremer et al. (2020) identified five opportunities for hydrologic information to support overlapping management contexts: (1) inspire action and support, (2) inform investment decisions, (3) engage with potential participants, (4) prioritize location and types of activities at regional to national scales, and (5) evaluate program success. Bremer, L.L., Hamel, P., Ponette-González, A.G., Pompeu, P.V., Saad, S.I. and Brauman, K.A., 2020. Who are we measuring and modeling for? Supporting multilevel decision-making in watershed management. *Water Resources Research*, *56*(1), p.e2019WR026011. Dunn, A.D., 2010. Siting green infrastructure: legal and policy solutions to alleviate urban poverty and promote healthy communities. BC Envtl. Aff. L. Rev., 37, p.41. Lubell, M., 2004. Collaborative watershed management: A view from the grassroots. Policy Studies Journal, 32(3), pp.341-361. Surya, B., Syafri, S., Sahban, H. and Sakti, H.H., 2020. Natural resource conservation based on community economic empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi, Indonesia. Land, 9(4), p.104.

suggest that ***any goal statement should: (1) identify the biological objective(s), (2) address underlying causes of ecosystem degradation (Parker 1997; Beechie and Bolton 1999; McElhany et al. 2000), and (3) acknowledge social, economic, and land use constraints (Slocombe 1998).***

A. DEFINE WHAT IT MEANS TO RESTORE AND MAINTAIN THE FISHERIES

13. "Restore" and "maintain" are separate objectives within the overall watershed management goal under the FAHCE Agreement. Restore means to bring back to a previous, agreed-upon state and maintain means management in perpetuity to keep at an agreed-upon state. These both should be put in measurable terms.

14. "Habitat Restoration" is a frequently used term that appears in a variety of arenas. The term covers the general topic of restoring ecosystems for the specific purpose of providing habitat—either for the individual species or for the entire suite of species likely to be found in an area (Miller and Hobbs 2007). It is a subset of overall ecosystem and species management. Considering Guadalupe River and Stevens Creek are regulated, and historic channel and floodplains are now developed, restoration of specific ecosystem services or processes must be incorporated into an overall maintenance plan within the Adaptive Management Program.

15. A key element of adaptive management is the ***creation of quantitative metrics against which to assess performance and trigger adjustments in management strategies*** (Doremus et al. 2001). These metrics should be grounded in science and provide a clear technical basis for tracking progress toward management goals (Schultz and Nie 2012). Two types of metrics are particularly important:

(1) quantitative targets representing achievement of a management objective, and

(2) interim indicators of progress, which can provide early warning of the need to adjust management strategies (Christian-Smith and Abhold 2015). These metrics may be designed as indicators of the health or sustainability of a resource.

16. As described in more detail below, the first goal of the Adaptive Management Program should be to identify what a population in "good condition" is in measurable terms. Then determine habitat needs to support that population, and then determine the habitat presently available. If the habitat presently available is insufficient to support the population, then develop a restoration plan to meet or exceed habitat needs. This activity is then incorporated into the adaptive management process.

17. According to the Ecological Society of America, the science of ecological restoration emphasizes recovery of ***self-sustaining*** living systems, ***including both the organisms and the environmental factors that support them***. According to Palmer and Ruhl (2015), the National Oceanic and Atmospheric Administration, defines "restoration" for the purposes of the Natural Resource Damages Assessment and Restoration Program to mean "any action (or alternative), or combination of actions (or alternatives), to restore, rehabilitate, replace, or acquire the ***equivalent*** of injured ***natural resources and services***" (15 C.F.R. § 990.30).

B. DEFINE FISH IN "GOOD CONDITION"

18. The FAHCE Agreement uses the term "good condition" to describe the overall management goal. This term is found in Section 5937 of the California Fish and Game Code, which requires,

> The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around, or through the dam, to keep in good condition any fish that may be planted or exist below the dam.

19. The critical term "good condition" is not defined in the code, but in a historic court case that resulted in increased stream flows into Mono Lake, Mono County (Koehler 1996), a state court basically accepted the definition of California Department of Fish and Game (now California Department of Fish and Wildlife) biologist, Darrell Wong:

> The instream flows necessary to keep fish in good condition include those which will maintain a ***self-sustaining population*** of ***desirably sized adult*** ... ***fish which are in good physical condition*** .... The fish populations should contain ***good numbers of different age classes***; and ***habitats for these age classes should not be limiting*** .... The ecological health of a stream will determine if the fish ... are to be kept in good condition (Unpublished testimony, 1993, State Water Resources Control Board; emphasis added).

20. According to Bork et al. (2011), *California Trout, Inc. v. Superior Ct.*, 218 Cal. App. 3d 187, 213, 266 Cal. Rptr. 788, 803–04 (Ct. App. 1990) (CalTrout II), offers the clearest existing guidance on the good condition standard in Section 5937. The court in CalTrout II required sufficient flow "to restore the historic fishery." *Id.* at 210. The court also observed that Section 5937 requires passage of "the amount of water required to sustain the pre-diversion carrying capacity of fish" in a stream. The court in *Natural Resources Defense Council v. Patterson*, 333 F. Supp. 2d 906, 916 (E.D. Cal. 2004), echoed this call, finding that "the relevant state law [5937] directs the Bureau [of Reclamation] to release sufficient water to 'reestablish and maintain' the 'historic fisheries.'" However, the State Water Resources Control Board (State Water Board) bypassed the simplistic historical approach in its East Fork Walker River Order [Bork et al. 2011], where it recognized that a current fishery may not have a historical counterpoint for comparison. In that case, the State Water Board found that any flow causing an "adverse effect" on the fish constituted a violation of Section 5937's good condition requirement.

21. Restoring flow alone may not always restore a historical fishery. Many ecosystems can no longer support native fisheries due to wholesale changes in ecosystem form and function, and the introduction of non-native species. Recognizing this, the Putah Creek Water Cases moved beyond the historical conditions approach to a broader definition of good condition, as outlined by Dr. Peter Moyle.[4] In the past decade, Moyle's definition has emerged as the most broad-based and applicable standard for assessing Section 5937's good condition component (Bork et al. 2011). This definition originated in the CalTrout cases, and Moyle expanded it from a single species approach, as was appropriate in those ecosystems, to include the diverse historical community of fishes living in the creek below the Putah Creek Diversion Dam (Bork et al. 2011).

22. Based on his expertise in California fisheries, Moyle determined that when multiple fish species are present below a dam, maintaining fish in good condition requires three levels of fish health: individual, population, and community. This finding extrapolates from the generic "adverse effect" language previously used by the State Water Board (Bork et al. 2011).

(1) At the individual level, a healthy individual should have a robust body conformation; should be relatively free of diseases, parasites, and lesions; should have reasonable growth rates for the region; and should respond in an appropriate manner to stimuli.

(2) At the population level, Moyle's definition of good condition is very similar to the CalTrout definition — that the population is viable. However, because it is hard to determine population viability, the definition adopted in the Putah Creek Cases relied on two indicators: "The first was that extensive habitat should be available for all life history stages. The second was that all life history stages and their required habitats should have a broad enough distribution in the creek to sustain the species indefinitely."

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4 Moyle's definition of good condition was also ultimately employed in the Friant Dam settlement, although it was not the view espoused by the court in that case (Bork et al. 2011).

(3) Moyle based the community level of the good condition definition on his extensive studies of stream fish assemblages and stream ecology in general, supplying criteria that can be replicated by fish ecologists and fisheries managers. A fish community is in good health if it:

(a) is dominated by co-evolved species,

(b) has a predictable structure as indicated by limited niche overlap among the species and by multiple trophic levels,

(c) is resilient in recovering from extreme events,

(d) is persistent in species membership through time, and

(e) is replicated geographically.

23. Based on these criteria for healthy individuals, populations, and communities, Moyle developed the Putah Creek flow regime that was largely adopted in the Putah Creek Cases and subsequent litigation. This approach offers a scientific framework for assessing good condition when a historical approach may not be feasible or appropriate (Bork et al. 2011), such as on the Guadalupe River, Coyote Creek, Stevens Creek (Three Creeks). Specifically, we acknowledge wholesale changes in ecosystem form and function, and the introduction of non-native species within the Three Creeks. As articulated in Moyle's five bullets above, population recovery targets are usually set at a level that will ensure the long-term persistence of a species (Rosenfeld and Hatfield 2006). As I pointed out in the Minimum Population Goals Analysis (Attachment 1.1), this target may be arrived at in several ways. If sufficient data exist to parameterize a population model that incorporates temporal variability in demographic and environmental conditions, then a formal population viability analysis (PVA; Morris and Doak 2002) can be performed to establish a minimum recovery target. The validity of PVA as a method for assessing extinction risk has come under intense scrutiny (Coulson et al. 2001; Ellner

et al. 2002; Reed et al. 2002), but it remains a useful quantitative tool for setting recovery targets and exploring how different management scenarios affect extinction risk (Brook et al. 2000; Haight et al. 2002), provided results are interpreted conservatively (Brook et al. 2002; Lindenmayer et al. 2003). However, sufficient information to perform a PVA is often lacking for listed species (Morris et al. 2002), usually because time and resources have not been available to obtain the necessary demographic parameters. In this case interim recovery targets need to be set based on available data until more accurate targets can be derived. One simple approach is to set recovery targets based on generic minimum viable population sizes.

24. Since the time of these findings, significant work has been done to define a viable population size for Pacific salmonids. McElhany et al. (2000) suggested that Pacific salmon population viability should be assessed in terms of abundance, productivity, spatial structure, and genetic and life-history diversity. According to Lindley et al. (2007), the federal Endangered Species Act, as amended in 1988, requires that recovery plans have quantitative, objective criteria that define when a species can be removed from the list, but does not offer detailed guidance on how to define recovery criteria. Logically, some of the recovery criteria should be biological indicators of low extinction risk. Recovery plans prepared since 1988 typically have about six recovery criteria, but only about half of these are quantitative or clearly related to biological information (Gerber and Hatch 2002). Gerber and Hatch (2002) found a positive relationship between the number of well-defined biological recovery criteria and the trend in abundance for the species. This empirical finding supports the concept that well-defined recovery goals are important for recovering populations and species (Lindley et al 2007).

25. Under this logic, fish management planning under FAHCE should start with defining minimum viable population numbers (i.e., those that are at low extinction risk) for the two target species. This approach is conservative and protectionary, as it uses the lower end of "good condition" as the starting point. An alternative approach would be to develop population numbers based on the potential of the watershed, which represent the upper end of "good condition." For example, the "intrinsic potential" concept might be used to bookend the upper end (Bjorkstedt et al. 2005). Approaches based on the watershed potential are more resource intensive and would require more time than Valley Water and other Initialing Parties have indicated is desirable. However, regardless of the starting point for analysis purposes, "good condition" ultimately defines a viable fishery, not just a marginally self-sustaining population (Bork et al. 2011).

26. Spence et al. (2008), establish extinction risk criteria based on effective population size. These criteria are intended to address risks associated with inbreeding and the loss of genetic diversity within a population. The criteria, for salmonid populations in general, is 2500 for low extinction risk and 250 for high extinction risk. Effective population is assumed to be 20% of the total population size; and, since both effective and total population are generational, to relate it to annual run size, one would divide the total population size by the average age at reproduction (Brian Spence pers. comm.). In doing this for federal recovery planning purposes, Spence et al. (2008) assumed average age of three years for both Chinook

salmon and steelhead. The resulting high-risk population estimate, expressed as annual run size, would be 83 (50/0.2/3) for high extinction risk, and 833 for low extinction risk.[5]

II. THE DEIR DOES NOT SHOW THE PROPOSED PROJECT OR ALTERNATIVES WILL MEET THE CRITERIA TO MAINTAIN FISH IN GOOD CONDITION.

27. The DEIR mentions "performance objectives" 34 times but does not actually describe what the "performance objectives" are.

28. The DEIR mentions "Available Habitat" 12 times, but "available habitat" is not articulated in measurable terms other than comparisons of percent change; not in relationship to supporting "good condition". In other words, if performance comparisons indicate an action would increase habitat by 100%, that could be a shift from 1 acre to 2 acres or 50 acres to 100 acres of available habitat. Percent is, therefore, relevant to present available habitat but not necessarily to meeting the needs of a low-extinction population.

29. The DEIR states, "[a] key Settlement Agreement provision is to implement reservoir flow releases and restoration measures (Proposed Project) to support salmon and steelhead …." In order to show the Proposed Project will support the target fisheries, measurable goals should be clearly articulated, setting the stage for explanation of why certain

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[5] An effective population size (Ne) of at least 50 (Franklin 1980; Soulé 1980) has long been recommended as a "rule" for avoiding inbreeding depression in the short term. Ne = 500 has been considered sufficient to retain evolutionary potential in perpetuity (Franklin 1980; Lande and Barrowclough 1987). These two issues had important roles in the development and implementation of the IUCN Red List categorization system for threatened species (Mace et al. 2008). We note that, Frankham et al. (2014) argues that this is even too conservative and that N≥100 and N≥1000 are more appropriate. *See* Frankham, R., Bradshaw, C.J. and Brook, B.W., 2014. Genetics in conservation management: revised recommendations for the 50/500 rules, Red List criteria and population viability analyses. Biological Conservation, 170, pp.56-63; Franklin, I.R., 1980. Evolutionary change in small populations. In: Soulé, M.E.,Wilcox, B.A. (Eds.), Conservation Biology: An Evolutionary-Ecological Perspective. Sinauer, Sunderland, MA, pp. 135–149. Lande, R., Barrowclough, G.F., 1987. Effective population size, genetic variation, and their use in population management. In: Soulé, M.E. (Ed.), Viable Populations for Conservation. Cambridge University Press, Cambridge, pp. 87–123. Mace, G.M., Collar, N.J.,

methodologies were used within the document. Based on my review, the methods used are not adequately described in the DEIR. The DEIR references the appendices; however, the appendices, especially Appendix A, do not adequately describe methods nor do they articulate how restoration locations were chosen nor the quantity of habitat to be enhanced/restored. That is, why measure habitat? Is it only to demonstrate a physical change under FAHCE implementation, to complete the California Environmental Quality Act (CEQA) process, or to identify quantifiable habitat that supports a fishery in "good condition"?

30. Again, assuming the goal of measuring habitat is to achieve fisheries in "good condition", as stated in the FAHCE Agreement, clear articulation of "good condition" and determining the quantity and quality of habitat needed to support "good condition" are needed. As it stands, the DEIR appears to articulate selection of a preferred alternative by comparing its modeled outcome against "no alternative" conditions. This then suggests the goal is to simply be "better" than present conditions, whether that supports a fishery in "good condition" or not. No articulation of estimation error is provided so that when a percent increase in rearing habitat is provided, there is no way for reviewers to determine if it is simply within the error range for the modeling quality used. In short, the DEIR does not appear to analyze whether changes will produce biological response or if the percent change is within or outside of the margin of error.

III. ADDITIONAL ANALYSIS IS NEEDED TO SHOW THE PROPOSED PROJECT WILL SUPPORT FISH IN GOOD CONDITION.

31. Pursuant to the FAHCE Agreement, Valley Water developed a Fish Habitat Restoration Plan (FHRP) that includes proposed modifications to its reservoir operations and programmatic actions to improve habitat conditions on the Three Creeks as necessary to achieve

the FAHCE Agreement's restoration goals. Per section 6.2.2 of the FAHCE Agreement, the FHRP and attendant conservation measures (Proposed Program) should be designed to achieve the following Overall Management Objectives: (A) suitable spawning and rearing habitat within each watershed, and (B) adequate passage for adult steelhead trout and Chinook salmon to reach suitable spawning and rearing habitat and for out-migration of juveniles. According to section 7.3, the Proposed Program will be subject to adaptive management based on measurable objectives.

32. As stated above, to evaluate alternative measures for inclusion in the Proposed Program and establish measurable objectives for adaptive management, it is necessary to translate the FAHCE Agreement's qualitative goals into quantifiable terms. Quantifiable restoration objectives are essential for guiding the development and implementation of restoration efforts and establishing a means to measure progress and evaluate success (Rosenfeld and Hatfield 2006). To this end, I suggest estimating minimum viable populations for salmon and steelhead on the Three Creeks and the habitat needed to support the target number of individuals at each lifestage so as to support overall population goals, described as "critical habitat" or "H_{crit}." *See* Attachment 1.1. I also recommend that Valley Water, in consultation with stakeholders, develop general rules for determining habitat, and hence water needs, for facilitating immigration and emigration of both populations for each of the watersheds.

33. Salmonid populations in regulated streams are influenced by a complex interplay of factors that range from individual stream flow levels and temperature to long-term habitat degradation associated with altered sediment budgets and migration routes, and shifts in ocean conditions. Achievement of management goals relies on restoration actions that involve both

discharge (e.g., dam releases) and non-discharge (e.g., gravel augmentation, diversion screening, etc.) components, and these are inter-related (Merz et al. 2013). Therefore, successful attainment of FAHCE Agreement goals requires that:

a. A quantifiable measurement of "healthy steelhead and Chinook salmon populations" is defined (healthy populations) for purposes of analysis.

b. A sufficient number of individuals *for each lifestage* can access and exit habitat when appropriate (adequate passage) to meet population recovery target(s).

c. Sufficient quantity and quality of habitat is available for each lifestage of each species to meet population recovery target(s) (suitable habitat).

d. Sufficient habitat must function at the appropriate time, location, and duration for each lifestage (suitable habitat).

e. Flow variability supports habitat heterogeneity in space and time (a spectrum rather than a window) to support opportunities for multiple life history strategies and ultimately, population diversity (suitable habitat).

34. GCRCD and CalTrout previously recommended that the stakeholders develop relationships between reservoir storage, flow, and habitat quantity and quality for target species to articulate quantifiable project goals and measure results to support Valley Water's Adaptive Management Program (Attachment 1.1; Attachment 1.2 (J. Merz, PowerPoint pres. (June 2017)). Two fundamental concepts relating salmonid production to stream habitat are: (1) stream-dwelling salmonids either defend or rely on food from a territory – maximum number of individuals that habitat can support is limited by fish territory size and amount of available suitable habitat; and (2) salmonids must be able to access and exit habitats as they develop and transition between lifestages.

35. There are a variety of methods for modeling and investigating flow impacts on these fisheries' needs, including capacity-based limiting factors models (e.g., Reeves et al. 1989;

Beechie et al. 1994; Cramer and Ackerman 2009), multi-stage spawner-recruit life cycle models (e.g., Schuerell et al. 2006; Zeug et al. 2012), net-rate of energy intake (NREI) (Wall et al. 2015), and habitat suitability models using hydraulic modeling based on fish habitat preferences (Ghanem et al. 1996; Lacey and Millar 2004; Pasternack and Wang 2004). Flow modeling can support any of these approaches whereby capacity, NREI or suitability are derivatives of depth and velocity (or cover, substrate, or other hydraulic factors).

36. Multi-stage spawner-recruit life cycle models, while they have been used to evaluate flow options (e.g., Zeug et al. 2012), are complex, time-consuming efforts, that require lifestage specific data not available for these watersheds. Similarly, NREI and other food web-based models require collection of not only fish data, but primary (periphyton) and secondary production (macroinvertebrates) and would require hydraulic modeling to be completed. In contrast, capacity-based limiting factors and habitat suitability models have been widely used for modeling changes in usable habitat at various flows or habitat improvement scenarios. Capacity-based limiting factor models use estimates of habitat area and fish densities to estimate capacity at different lifestages with fixed survival estimates between lifestages, effectively converting lifestage-specific capacity to potential fish production (Roni et al. 2018). In contrast, habitat suitability models simulate the physics of water flow along with habitat suitability preferences to determine eco-hydraulic (e.g., how hydraulics impact fish) effects. Then areas of suitable habitat are related to territory size (typically for juvenile fish) or assumed densities (for spawners) so that capacity can be estimated. These two approaches are complementary with the capacity-based model being coarser and less costly than the habitat suitability modeling, but less accurate and precise in terms of predicting changes in habitat. An option that combines both approaches

would provide a comprehensive evaluation, as the former would estimate total capacity, and the latter would estimate changes in habitat suitability by species and at various flows.

37. As shown in the DEIR, Valley Water did not implement our recommendation to use modeling studies to develop relationships between reservoir storage, flow, and habitat quantity and quality for target species. Instead, the Initialing Parties agreed to a much coarser methodology using older habitat mapping performed by Entrix to develop crude habitat availability models (flow-available habitat relationships). We generally agreed to this approach on the understanding that previous habitat mapping would be validated through additional survey work. I hoped that development of the Water Evaluation and Planning (WEAP) tool, and attendant modeling, would allow the collaborative team to estimate storage and release strategies that support each salmonid lifestage along the entire watershed corridor accessible to these anadromous fish. Unfortunately, Valley Water did not undertake this exercise in collaboration with stakeholders. As a result, the reliability of the comparative results is uncertain because the supporting methodologies and analysis are not provided in the DEIR or otherwise available. A key tenet of the scientific method is that a contemporary practitioner could track and implement the methods and a similar outcome would occur. Given that it is not disclosed, reviewers, including regulators, have no way to adequately evaluate if this methodology is sound or make specific recommendations to improve if deficiencies are observed.

38. I recommend Valley Water re-engage with stakeholders to implement the general process outlined in the Minimum Population Goals Analysis (Attachment 1.1):

a. Use methods articulated in this document to identify population goal for Chinook salmon and steelhead in each of the watersheds, including diversity of lifestages and strategies;

b. Determine how many individuals of each species must survive through each life stage to meet the goal;

c. Using methods outlined in the Minimum Population Goals Analysis, estimate how much potential physical habitat is needed for each life stage to meet the goal;

d. Using methods outlined in the Minimum Population Goals Analysis, determine timing and duration of habitat activation and access for each species for each watershed;

e. Use flow – Habitat Suitability Index relationships to determine the relationship between flow and physical habitat needs for each species, including passage (both immigration and emigration), and 2-D modeling (or Entrix data, if validated) as inputs to WEAP model to evaluate flow scenarios;

f. Use available water and channel bathymetry to determine if adequate potential habitat is available to support each life stage of each population goal.

39. Once these steps are accomplished, I recommend a secondary, collaborative process is undertaken with stakeholders to determine the potential for each watershed to support populations of target species by gaming the relationships between flow, channel bathymetry, and the range of species' capabilities available in the literature. Using this gaming process, Valley Water in collaboration with stakeholders can develop one or more feasible action alternatives (comprised of specific flow and non-flow measures) that is most likely to support viable populations of Chinook salmon and steelhead into the foreseeable future while minimizing any conflicts with other uses.

IV. LITERATURE CITED

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Attachment 1.1

FISHERIES AND AQUATIC HABITAT COLLABORATIVE EFFORT: POPULATION CRITERIA AND HABITAT SUPPLY MODEL TO INFORM FISHERY MANAGEMENT IN THE THREE CREEKS

BACKGROUND

The Fish and Aquatic Habitat Collaborative Effort Settlement Agreement, which was initialed by the Santa Clara Valley Water District (SCVWD), Guadalupe Coyote Resource Conservation District (District), California Department of Fish and Wildlife (CDFW), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), California Trout, Trout Unlimited, Pacific Coast Federation of Fishermen's Associations, Northern California Council of Federation of Fly Fishers (now Northern California Council Fly Fishers International) (collectively, Initialing Parties) calls for the restoration of salmon and steelhead fisheries to good condition on the Guadalupe River, Coyote Creek, and Stevens Creek watersheds (collectively, Three Creeks) in northern Santa Clara County, California.

Pursuant to the FAHCE Agreement, the SCVWD is preparing a Fish Habitat Restoration Plan (FHRP) that includes proposed modifications to its reservoir operations and programmatic actions to improve habitat conditions on the Three Creeks as necessary to achieve the FAHCE Agreement's restoration goals. Per section 6.2.2 of the FAHCE Agreement, the FHRP and attendant conservation measures (Proposed Program) should be designed to achieve the following *Overall Management Objectives*: (A) suitable spawning and rearing habitat within each watershed, and (B) adequate passage for adult steelhead trout and Chinook salmon to reach suitable spawning and rearing habitat and for out-migration of juveniles. According to section 7.3, the Proposed Program will be subject to adaptive management based on measurable objectives.

To evaluate alternative measures for inclusion in the Proposed Program and establish measurable objectives for adaptive management, it is necessary to translate the FAHCE Agreement's qualitative goals into quantifiable terms. Quantifiable restoration objectives are essential for guiding the development and implementation of restoration efforts and establishing a means to measure progress and evaluate success (Rosenfeld and Hatfield 2006). To this end, we estimated minimum viable populations for salmon and steelhead on the Three Creeks and the habitat needed to support the target number of individuals at each lifestage so as to support overall population goals, described as "critical habitat" or "H_{crit}." We also provide general rules for determining habitat, and hence water needs, for facilitating immigration and emigration of both populations for each of the watersheds.

This analysis is intended to form the basis of a simple life cycle model that can be used to optimize water allocation in the Three Creeks to meet multiple water needs, including management of healthy steelhead and Chinook populations. Our approach, under time constraints, was to pair information about minimum fish territory requirements with a simple model that can estimate the number, movement, and size of Chinook salmon and steelhead from adult spawning, to emergence to river exit, to provide spatially explicit estimates of habitat required to support minimum population abundances. We created a deterministic simulation model that tracks spawning, incubation, rearing and emigration of a single population of Chinook salmon and steelhead. Whenever possible, we used data and literature values derived from the Three Creeks to inform model relationships. When local data were lacking, we applied the best available laboratory or out-of-basin data sources.

The analysis is based on two core assumptions: there is a positive relationship between habitat and population size, and a minimum habitat area is required to meet a recovery target (Figures 1 and 2).

Figure 1. Defining critical habitat is illustrated as a three-step process. (1) A population recovery target is determined (N_{target}). (2) A relationship between habitat and abundance is developed. (3) The recovery target and the habitat–abundance relationship is used to define the quantity of habitat required to meet the recovery target (H_{crit}). H_{crit} will differ depending on the form of the habitat–abundance function. Habitat–abundance relationships will be linear if the number of recruits to a habitat increases proportionally with area (solid line). If the number of recruits is fixed, the relationship will asymptote and display nonlinearity because of density-dependent effects on survival (broken line). High-quality habitat will generally have higher survival rates, resulting in a steeper abundance–area relationship. Note that the horizontal axis can be any measure of habitat quantity (area, volume, stream discharge, etc.). Reproduced from Rosenfeld and Hatfield (2006).

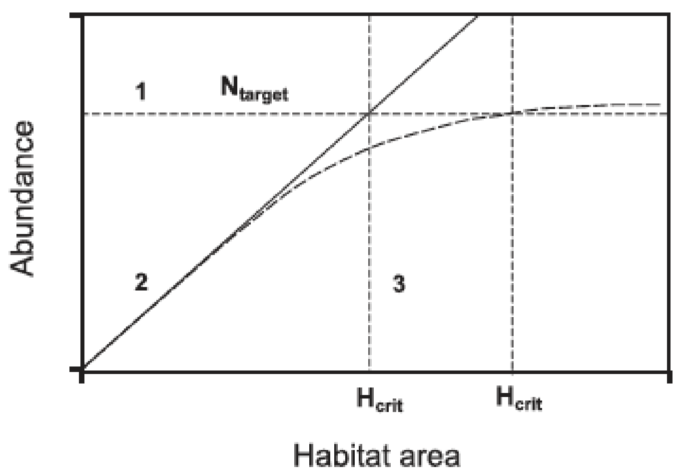
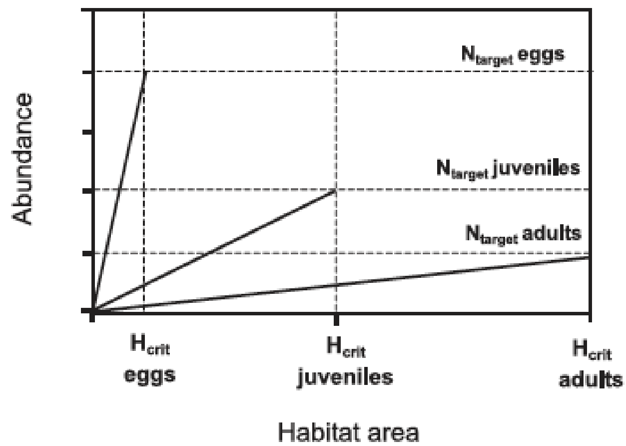


Figure 2. For species with multiple life history stages, sufficient individuals need to recruit to each life history stage to meet the adult recovery target. When life history stages are dependent on different habitats, separate habitat–abundance relationships, stage-specific population targets, and critical habitat areas need to be defined to meet the adult population recovery target. Population targets for early life history stages will depend on stage-specific survival rates. Note that the habitat area required by different lifestages will depend on species ecology, although this figure assumes that individual and cohort area requirements increase from eggs to juveniles to adults. Egg-to-juvenile and juvenile-to-adult survivals are set at 25% and 40%, respectively, for illustration purposes. N_{target}, a population recovery target; H_{crit}, the quantity of habitat required to meet the recovery target. Reproduced from Rosenfeld and Hatfield (2006).



Salmonid populations in regulated streams are influenced by a complex interplay of factors that range from individual stream flow levels and temperature, to long-term habitat degradation associated with altered sediment budgets and migration routes, and shifts in ocean conditions. Achievement of management goals relies on restoration actions that involve both discharge (e.g., dam releases) and non-discharge (e.g., gravel augmentation, diversion screening) components, and these are inter-related (Merz et al. 2015). Therefore, successful attainment of FAHCE settlement goals requires that:

1) A quantifiable measurement of "healthy steelhead and Chinook salmon populations" is defined (healthy populations) for purposes of analysis.
2) A sufficient number of individuals *for each lifestage* can access and exit habitat when appropriate (adequate passage) consistent with the population recovery target.
3) Sufficient quantity and quality of habitat is available for each lifestage consistent with the population recovery target (suitable habitat).
4) Sufficient habitat must function at the appropriate time, location, and duration for each lifestage (suitable habitat).
5) Flow variability supports habitat heterogeneity in space and time (a spectrum rather than a window) to support opportunities for multiple life history strategies and ultimately, population diversity (suitable habitat).

With this in mind, the relationship between reservoir storage, flow, and habitat quantity and quality for target species, must be determined. Two fundamental concepts relating salmonid production to stream habitat are: (1) stream-dwelling salmonids either defend or rely on food from a territory – maximum number of individuals that habitat can support is limited by fish territory size and amount of available suitable habitat; and (2) salmonids must be able to access and exit habitats as they develop and transition between lifestages.

There are a variety of methods for modeling and investigating flow impacts on these fisheries' needs, including capacity-based limiting factors models (e.g., Reeves et al. 1989; Beechie et al. 1994; Cramer and Ackerman 2009), multi-stage spawner-recruit life cycle models (e.g., Schuerell et al. 2006; Zeug et al. 2012), net-rate of energy intake (NREI) (Wall et al. 2015), and habitat suitability models using hydraulic modeling based on fish habitat preferences (Ghanem et al. 1996; Lacey and Millar 2004; Pasternack and Wang 2004). Flow modeling can support any of these approaches whereby capacity, NREI or suitability are derivatives of depth and velocity (or cover, substrate, or other hydraulic factors).

Multi-stage spawner-recruit life cycle models, while they have been used to evaluate flow options (e.g., Zeug et al. 2012), are complex, time-consuming efforts, that require lifestage specific data not available for these watersheds. Similarly, NREI and other food web based models require collection of not only fish data, but primary (periphyton) and secondary production (macroinvertebrates) and would require hydraulic modeling to be completed. In contrast, capacity-based limiting factors and habitat suitability models have been widely used for modeling changes in usable habitat at various flows or habitat improvement scenarios. Capacity-based limiting factor models use estimates of habitat area and fish densities to estimate capacity at different lifestages with fixed survival estimates between lifestages, effectively converting lifestage specific capacity to potential fish production (Roni et al. 2018). In contrast, habitat suitability models simulate the physics of water flow along with habitat suitability preferences to determine eco-hydraulic (e.g. how hydraulics impact fish) effects. Then areas of suitable habitat are related to territory size (typically for juvenile fish) or assumed densities (for spawners) so that capacity can be estimated. These two approaches are complementary with the capacity-based model being coarser and less costly than the habitat suitability modeling, but less accurate and precise in terms of predicting changes in habitat. An option that combines both approaches would provide a comprehensive evaluation, as the former would estimate total capacity, and the latter would estimate changes in habitat suitability by species and at various flows. The development of the Water Evaluation and Planning (WEAP) tool, and attendant modeling, allows us to estimate storage and release strategies that support each lifestage along the entire watershed corridor accessible to these anadromous fish. We now can identify a flow scenario that would provide physical habitat components (e.g., depth of flow and temperature) adequate to support each lifestage and achieve the minimum viable populations of steelhead and Chinook salmon for the Three Creeks.

This effort to optimize water allocation in the Three Creeks to meet multiple objectives, including management of healthy steelhead and Chinook populations, follows a general process for determining the ability of each watershed to support target salmonid populations (Figure 3). Within this document, we specifically define:

1) A Population recovery target - quantify viable steelhead and Chinook salmon populations;
2) Basic life history information, including identification of different life stages and their habitat associations (general demographics);
3) Availability of suitable habitat (present and potential);
4) Spawning habitat needs;
5) Incubation and emergence requirements;
6) Rearing habitat needs;
7) Migration needs – both immigration and emigration; and
8) Water quality needs.

Figure 3. General process for determining the ability of each of the watersheds to support target fish populations assuming a viable population goal is identified, habitat needs are quantified and a general relationship between potential habitat and flow is known.

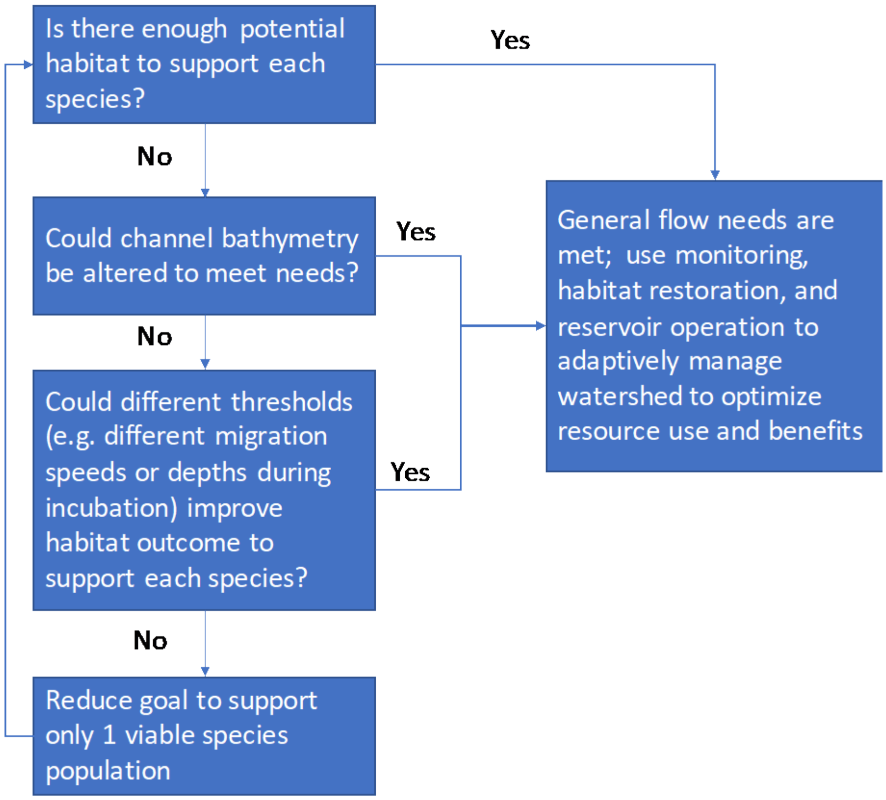
Process

1. Identify target species
2. Identify population goal
3. Determine how many fish need to survive through each life stage to meet goal
4. Determine how much potential physical habitat is needed for each life stage to meet goal
5. Determine timing and duration of habitat activation and access
6. Determine relationship between water and physical habitat needs
7. Use available water and channel bathymetry to determine if enough potential habitat is available to support each life stage of population goal*

*In absence of flow-HAI relationships to estimate suitable flows, use relationship between flow and depth criteria. Calculate estimated flow needed to achieve minimum target depth associated with each identified lifestage. Use these flows for the number of days needed to facilitate each life stage and transition

Once these steps are accomplished, a secondary process is undertaken to determine the potential for each watershed to support populations of target species by gaming the relationships between flow, channel bathymetry and the range of species capabilities available in the literature (Figure 4).

Figure 4. General flow chart for determining the potential of each watershed to support populations of target species.



POPULATION DEFINITION

SIZE (N)

Previous interpretations of "good condition" under California Fish and Game Code section 5937 have been applied at the population level to single species (Moyle et al 1998). For example, during testimony at the 1993 Mono Lake trial, the California Department of Fish and Game defined it in relation to the principal fish species present. The Department considered good condition to mean that each population must have (1) multiple age classes (evidence of reproduction), (2) a viable population size, and (3) healthy individuals (as above). Viable population size is difficult to quantify (both in theory and practice), so two surrogate indicators were relied on in the case of Putah Creek: first, extensive habitat should be available for all life history stages; and second, all life history stages and their required habitats should have a broad enough distribution within the creek to sustain, by multiple trophic levels, the species indefinitely (barring stream-long catastrophes) (Moyle et al. 1998).

Population recovery targets are usually set at a level that will ensure the long-term persistence of a species (Rosenfeld and Hatfield 2006). This target may be arrived at in several ways. If sufficient data exist to parameterize a population model that incorporates temporal variability in demographic and environmental conditions, then a formal population viability analysis (PVA; Morris and Doak 2002) can be performed to establish a minimum recovery target. The validity of PVA as a method for assessing extinction risk has come under intense scrutiny (Coulson et al. 2001; Ellner et al. 2002; Reed et al. 2002), but it remains a useful quantitative tool for setting recovery targets and exploring how different management scenarios affect extinction risk (Brook et al. 2000;

Haight et al. 2002), provided the results are interpreted with caution (Brook et al. 2002; Lindenmayer et al. 2003). However, sufficient information to perform a PVA is often lacking for listed species (Morris et al. 2002), usually because time and resources have not been available to obtain the necessary demographic parameters. In this case interim recovery targets need to be set based on available data until more accurate targets can be derived. One simple approach is to set recovery targets based on generic minimum viable population (MVP) sizes.

Since the time of these findings, significant work has been done on defining a viable population size for Pacific salmonids. McElhany et al. (2000) suggested that the viability of Pacific salmon populations should be assessed in terms of abundance, productivity, spatial structure, and genetic and life-history diversity. According to Lindley et al. (2007), the federal Endangered Species Act, as amended in 1988, requires that recovery plans have quantitative, objective criteria that define when a species can be removed from the list, but does not offer detailed guidance on how to define recovery criteria. Logically, some of the recovery criteria should be biological indicators of low extinction risk. Recovery plans prepared since the 1988 amendment typically have about six recovery criteria, but only about half of these are quantitative or clearly related to biological information (Gerber and Hatch 2002). Gerber and Hatch (2002) found a positive relationship between the number of well-defined biological recovery criteria and the trend in abundance for the species. This empirical finding supports the concept that well-defined recovery goals are important for recovering populations and species (Lindley et al 2007).

Under this logic, fish management planning under FAHCE should start with defining MVP numbers (i.e., those that are at low risk of extinction) for the two target species. This approach is conservative and protectionary, it uses the lower end of “good condition” as the starting point. An alternative approach would be to develop population numbers based on the potential of the watershed, which represents the upper end of good condition. For example, the “intrinsic potential” concept might be used to bookend the upper end (Bjorkstedt et al. 2005). Approaches based on the watershed potential are more resource intensive and would require more time than the Initialing Parties have indicated is desirable from a regulatory standpoint. However, regardless of the starting point for purposes of analysis, “good condition” ultimately defines a viable fishery, not just a marginally self-sustaining population (Bork et al. 2011).

Spence et al. (2008), establish extinction risk criteria based on effective population size.[1] These criteria are intended to address risks associated with inbreeding and the loss of genetic diversity within a population. The criteria, for salmonid populations in general, is 2500 for low extinction risk and 250 for high extinction risk. Effective population is assumed to be 20% of the total population size; and, since both effective and total population are generational, to relate it to annual run size, one would divide the total population size by the average age at reproduction (Brian Spence pers. comm.). In doing this for federal recovery planning purposes, Spence et al. (2008) assumed average age of 3 years for both Chinook salmon and steelhead. The resulting high-risk population estimate, expressed as annual run size, would be 83 (50/0.2/3) for high extinction risk, and 833 for low extinction risk.

DEMOGRAPHICS

Demographic analysis tracks change over time in the number of individuals at different ages or stages given a schedule of age- or lifestage-specific reproductive output and mortality (Gotelli 1998; Caswell 2001). Models can

[1] NMFS’ extinction risk criteria are available at https://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-423.pdf.

be constructed assuming continuous or annual reproduction and, in the latter case, assuming abundances pertain to the period just before or just after breeding occurs (Gedamke et al. 2007). A useful method for understanding when and how different habitat factors limit populations is to construct realistic models of population dynamics. Population models for species with discrete lifestages use information on individual-scale habitat requirements to parameterize sub-models for different lifestages, which are then sequentially linked to provide a whole life cycle model for a population (e.g., Holtby and Scrivener 1989; Nickleson and Lawson 1998; sometimes referred to as habitat supply models (Minns et al. 1996)). Sub-models for different lifestages can be understood simplistically in terms of the extent and quality of available habitat, which is related to cohort size by fitness functions relating organism growth and survival to habitat characteristics (Rosenfeld 2003). This method is what we propose to support fisheries management in the Three Creeks. However, it is important to note that successful populations typically utilize multiple life history strategies to be successful, including residency and anadromy (Schindler et al. 2010). Dam operations, including artificial, year-round suitable habitat, can lead to much higher rates of resident life history expression over anadromy (Sogard et al. 2012). Future research on these watersheds should help inform flow operations that support the variability of life history strategies that will maintain healthy populations.

We propose the following demographic parameters to populate the habitat supply model.

ADULT SIZE

We used data collected on 27251 steelhead and 743 Chinook salmon entering the Warm Springs Hatchery on the Russian River from 2004 – 2014. Mean steelhead length was 26.35 inches (minimum 14 inches, maximum 39 inches). Mean Chinook length was 27.41 inches (minimum 15inches, maximum 38 inches).

SEX RATIOS

There is little solid information on sex ratios for California Chinook and *O. mykiss* populations. Most coastal populations of *O. mykiss* are characterized by partial migration in which non-anadromous (resident rainbow trout)[2] and anadromous (steelhead) life-history forms are sympatric in freshwater habitats with access to the ocean (McPhee et al. 2007). However, the limited data on *O. mykiss* sex ratios do not show a consistent pattern of differential rates of anadromy between sexes. Long-term datasets of adult steelhead, for which the most data exist, show that sex ratios of returning spawners can fluctuate considerably among years (Shapovalov and Taft 1954; Ward and Slaney 1988; Savvaitova et al. 2002) and over longer periods (Ardren and Kapuscinski 2003). This variation notwithstanding, sex ratios of adult steelhead were approximately 1:1 in some systems (Shapovalov and Taft 1954; Ward and Slaney 1988) but female-skewed in others (Savvaitova et al. 2002; Ardren & Kapuscinski 2003). Shorter-term studies have paralleled these results, with some finding balanced sex ratios in adult steelhead (Pautzke & Meigs 1941; Chapman 1958) and others showing female-dominated returns (Hayes et al. 2004; McMillan et al. 2007; Pavlov et al. 2008). Under similar circumstances, other modelers have assumed a 1:1 ratio (Nickelson and Lawson 1998). Given the lack of consistent data, we used a 1:1 sex ratio.

FECUNDITY

The number and size of eggs laid by Chinook and steelhead are highly variable, among both individuals and populations (Lister 1990; Healey and Heard 1984; Healey 2001; Beacham and Murray 1993; Moyle 2002). Moyle

[2] Non-anadromous components of *O. mykiss* populations can be highly skewed to males (Rundio et al. 2012).

(2002) offers as a rule of thumb that steelhead carry about 2,000 eggs per kilogram of body weight. Based on Hallock et al.'s (1961) length and weight data and Moyle's rule of thumb, Central Valley steelhead of average weight would carry about 3,000 eggs (Williams 2006. The fecundity of 23 steelhead from Scott Creek, a coastal stream south of San Francisco, varied from under 2,000 to over 11,000, and the relation between fecundity and length was reasonably well described by F = 0.9471, Length 2.1169 (Shapovalov and Taft 1954). Individual variation was considerable, however, and Shapovalov and Taft remarked that a 60 cm female could have from 3,800 to 7,800 eggs.

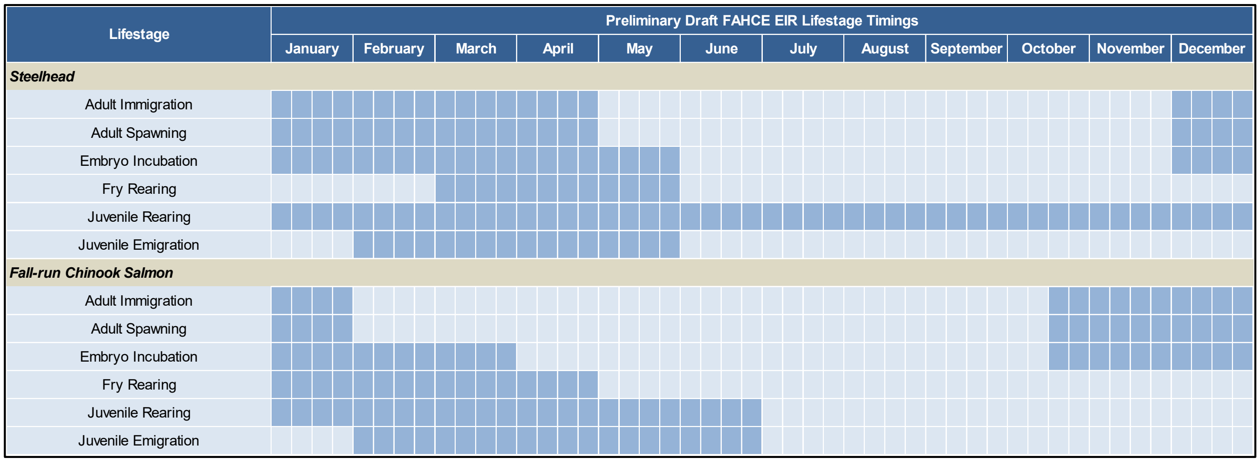
To calculate number of embryos we used the length to fecundity relationship of Kaufman (2009) and Hodge et al. (2014) and the mean FL for steelhead and Chinook provided above.

We assumed an average steelhead fecundity is 4402 and average Chinook fecundity is 4690.

TIMING

Estimating habitat availability for a species and lifestage over the appropriate time period is dependent on the lifestage-specific temporal distribution (i.e., the time period when a specific lifestage may be present). Therefore, species and lifestage-specific life histories are described in the following sections for Central California Coast (CCC) steelhead and Central Valley fall-run Chinook salmon (Fisheries Habitat Availability Estimation Methodology Working Draft 16 October 2017). It is generally understood that regional and river-specific environmental conditions influence inter-and intra-annual freshwater lifestage periodicities of an anadromous salmonid population. However, for evaluation purposes, a generalized life history periodicity was required for each lifestage of steelhead and fall-run Chinook salmon. Figure 3 presents the lifestage-specific temporal periods used to evaluate the effects of the Proposed Project and alternatives on habitat conditions in the draft environmental impact report the SCVWD is preparing under the California Environmental Quality Act. Evaluations conducted for each species and lifestage are further explained in working draft (Fisheries Habitat Availability Estimation Methodology Working Draft 16 October 2017). It is important for management not to limit juvenile emigration only to certain months – juvenile *O. mykiss* are capable of emigrating during every month of the year in other systems; if conditions warrant, juveniles are capable of multiple down, up, and back downstream migrations in lagoon systems on the Central Coast (Hayes et al. 2011). Once populations are established, spreading survival risk out temporally will allow different sized fish to emigrate, potentially ensuring at least some fish survive from different emigration events (Schindler et al. 2010).

Figure 5. Lifestage periodicities used in FAHCE EIR evaluation (16 October 2017).[3]



RATE OF IMMIGRATION (MIGRATION SPEED)

Rutter (1904) branded and released 150 Chinook at Rio Vista in September 1901, and three were recovered at hatcheries; these traveled ~6 to 8 km d^{-1} on average (Williams 2006). However, it is clear Chinook can migrate more rapidly. Gilbert (1921-22, cited in Greene 1926) recovered 18 marked Chinook in the Yukon River that migrated 69 km d^{-1} on average (range 34-84 km d^{-1}). The median migration rate of PIT-tagged spring Chinook passing dams 460 km apart on the Columbia River was about 28.9 km d^{-1}, ranging from 9.5 to 51.5 km d^{-1} (Matter and Sandford 2003); the tagged fish tended to migrate more rapidly as the season progressed, and the data suggest that medium-sized fish (70-80 cm) may migrate more rapidly than smaller or larger fish. Keefer et al. (2004) report a range of 7-21 and 19-31 km d^{-1} for steelhead and Chinook respectively. Estimates from similar-sized streams, as they are available, may help refine the modeling efforts.

MODELING MIGRATION NEEDS

Two key objectives of the Proposed Project are to provide adequate passage for (1) adult steelhead trout and Chinook salmon to reach suitable spawning and rearing habitat and (2) juvenile out-migrants to reach the marine environment. Water is the primary resource related to key goals of the Proposed Project. There are several key questions related to water and program goals. How much water is available? How much water is needed to facilitate salmonid populations in “good condition”? How much water is necessary to facilitate adult passage during immigration?

IMMIGRATION

Immigration is when adults return to freshwater to reproduce and is a foundational aspect of a population model. Immigrating adults are usually quite mobile, have relatively large energy stores and adults, particularly females,

[3] This figure provides a range of the expected occurrence for each life stage of each species. Variability in resource availability and individual cohort performance may shift or contract these periods in a given year.

carry gametes that seed the model for estimating future timing and amount of habitat needs during subsequent freshwater lifestages of each species.

KEY IMMIGRATION ASSUMPTIONS

- Steelhead and salmon must migrate (immigrate) from the ocean environment to spawning habitat in natal tributaries to complete life cycle.
- Enough adults must successfully immigrate from the ocean to spawning grounds to maintain the population in “good condition.”
- Immigration occurs during a specific window each year.
- To successfully immigrate, physical requirements, including water quality (temperature), depths and velocities must not surpass adult steelhead needs (requirements or capabilities).
- While water operations are not the only factor controlling the abundance (how many adults are in the ocean) or health of adults outside of the watersheds, the quantity and quality of freshwater environments on the Three Creeks is largely under the SCVWD’s control.
- An important component of this analysis is the burst swimming speed of adult salmon and steelhead because it can limit their ability to negotiate migration corridors; particularly when long, shallow riffles and runs are present (as detailed below). The upper limit of burst swimming speeds (6 sec duration), as reported by Bell (1973) and Powers and Orsborn (1985), was used in the generation of fish leaping profiles[4]:

Table 1. Fish speed for Chinook salmon and steelhead. Fish speed is in feet per second (FPS).

Species	Sustained	Prolonged	Burst
Steelhead	0-4.6	4.6-13.7	13.7-26.5
Chinook	0-3.4	3.4-10.8	10.8-22.4

The leaping profiles assumed burst speeds of 26.5 feet per second (fps) for steelhead, and 22.4 fps for Chinook. According to Bell (1986) cruising speed is used during migration, sustained speed for passage through difficult areas, and darting speed for escape and feeding. Water velocities of 3.4 fps approach the upper sustained swimming ability of salmon and steelhead.

PASSAGE BARRIERS

We considered a feature as a potential barrier if a salmon or steelhead is forced to use prolonged or burst speed to the point of fatigue to navigate it. Any time a fish is forced to use burst speed, fatigue occurs after 6 seconds (Bell 1973). Therefore, burst speed multiplied by 6 seconds equals the distance a fish can burst before fatigue sets in (82.2 – 159 ft from table above). Due to the resulting fatigue, insufficient water depths over long distances can impede passage. In very shallow water, depth can influence swimming speeds because of extra energy involved in the formation of a “bow” wave. This effect only occurs at depths less than 3x a fish’s body depth, and affects burst swimming rather than sustained swimming. For example, in water = 0.3 times fish depth, maximum swimming speeds may be reduced 50-70% than those attained in deeper water (Webb

[4] Prolonged swimming speed was defined to include activities that led to fatigue within 15 seconds to 200 minutes. Burst speeds were defined as speeds leading to fatigue within 15-20 seconds or less.

et al. 1991).[5] A salmon or trout also can become fatigued or distressed where depths are so shallow that the fish's body, including gills are out of the water (Bell 1990).

CURRENT RULES FOR STEELHEAD - ADULT IMMIGRATION

The steelhead adult immigration period is December through April.

The FAHCE Settlement Agreement puts passage depth at 0.7 ft. NMFS's 2001 guidelines describe 1.0 ft min water depth as low fish passage. Everest et al. (1985) puts depth at 0.79 ft.

Suitable temperature is generally assumed to be 64 degrees F (17.8 degrees C).

GENERAL PASSAGE RULES

Passage must occur during the timing expected for upstream migration. When a passage event is created, it must occur for the duration needed for a fish to make it from the estuary to the most upper reach that contains spawning and/or holding habitat. Assuming a normal population distribution and a minimum of 83 fish needed to pass during the migration period, allow enough passage during each passage month to facilitate immigration of at least 83 adults to the highest reach capable of facilitating spawning habitat during the immigration period (i.e. 5% of 83 first month, 20% of 83 second month, etc.).

Run-off can be used to support passage, especially if it replaces water that can be used to maintain coldwater storage in reservoirs. If water temperatures will not facilitate incubation during the entire incubation period, then passage should not be facilitated past a point that incubation would not succeed (use thermal units to calculate this).

Passage means that water quality (temperature), flows, depths, velocities and jump heights must facilitate the range of fish sizes (depths, swimming speeds) expected in each reach of interest (ROI) and at each point of interest (POI) to get fish from the bottom to the top. Typical migration speed for a range of adult sizes for each species should be used to calculate the appropriate duration for each pulse event.

Immigration barrier rules should be used to ensure that any POI that stresses immigrants receives higher flows to reduce stress to insignificance.

We assume a migration speed of 7-21 km d^{-1} (14.24 km d^{-1} average) = 4.4 – 13 miles/d (8.8 miles average) (Keefer et al. 2004).

In this case, if fish are forced to use burst speed (which can be caused by too shallow a depth), then length of shallow area can be no longer than 82 ft (conservative). If any shallow areas are greater than 82 ft, then depth must be increased to 3x body depth (conservative).

[5] Webb, P.W., SimS, D. and Schultz, W.W., 1991. The effects of an air/water surface on the fast-start performance of rainbow trout (Oncorhynchus mykiss). Journal of experimental biology, 155(1), pp.219-226.

The distance from the San Francisco Bay to POIs in Stevens Creek is found in the Methods for Establishing Reaches of Interest and Points of Interest memo (June 2016). POI 6 is the one right below Stevens Creek reservoir while POI 1 is the closest to the Bay.

Figure 6. Estimated migration time for Chinook salmon and steelhead within the Three Creeks Project footprint assuming speeds reported in Keefer et al. 2004.

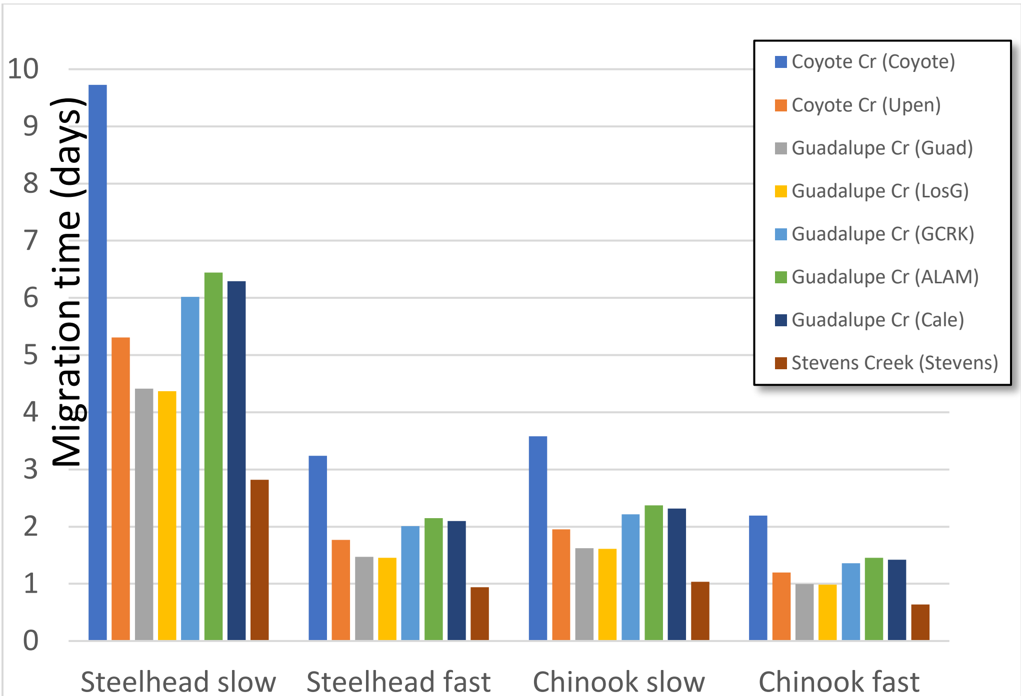


Table 2. Estimated duration of pulse flows needed to facilitate adult Chinook salmon and steelhead migrating from estuary to upper spawning grounds in each of the three watersheds. Estimates are in days (24 hr.) using range of migration speeds provided in Keefer et al (2004).

Watershed	Steelhead slow	Steelhead fast	Chinook slow	Chinook fast
Coyote Cr (Coyote)	9.7	3.2	3.6	2.2
Coyote Cr (Upen)	5.3	1.8	2.0	1.2
Guadalupe Cr (Guad)	4.4	1.5	1.6	1.0
Guadalupe Cr (LosG)	4.4	1.5	1.6	1.0
Guadalupe Cr (GCRK)	6.0	2.0	2.2	1.4
Guadalupe Cr (ALAM)	6.4	2.1	2.4	1.5
Guadalupe Cr (Cale)	6.3	2.1	2.3	1.4
Stevens Creek (Stevens)	2.8	0.9	1.0	0.6

It is important to note that immigrants may utilize a variety of migration strategies. For example, Coyote Creek is a relatively long system and, historically, every adult probably did not make it to the top of the system during a single storm event. More likely, they would have spread out through the system or gone as far upstream as they could, with some waiting for the next storm to move up and some being content to spawn wherever in the system they could reach and then attempting to head back to the Pacific (for steelhead).

EMIGRATION

When and how emigrants leave a natal stream depends on individual genetics, social cues, and environmental factors individuals are exposed to as they emerge, rear, and migrate downstream. Juvenile emigration size varies extensively. For example, juvenile fall-run Chinook emigrate as fry [<55 mm Fork Length (FL)], parr (>55 mm FL and <75 mm FL), or smolts (>75 mm FL). The proportion of salmon leaving as fry, parr, or smolts may shift from year to year. Flow (depths and velocities), photo-period, water quality (e.g., temperature, turbidity), diversion, and predation are thought to be key parameters affecting successful emigration (Cavallo et al 2013; Zeug et al. 2014). When modeling emigration needs, a general principal for success should be that within the most restrictive ROI, habitat must meet minimum depth and temperature requirements during the rearing period. For instance, gaming could/should be done to determine actions to trigger emigration if modeling is suggesting habitat may become liming. For instance, the model of Zeug et al (2014) could be used to trigger emigration during the pre-smolt period for fall-run if temperatures are becoming stressful in rearing reaches. Similarly, models or hypotheses could be used to determine pulse rules for steelhead. Future monitoring could test these hypotheses through the adaptive management process.

While runoff may facilitate emigration triggers in many years, incorporating an artificial trigger to make sure they happen at least once a year at a time that initiates appropriate movement is imperative. It will be important to define what an emigration trigger is so that when a trigger is met via runoff, it is not duplicated with stored water. This may be as simple as ensuring the entire stream is connected and temperatures are within a sufficient range to facilitate emigration. However, preparation for and successful entry into the marine environment is a complex process. For instance, individual steelhead in these populations may smolt at ages 1-3 years. Furthermore, it has been observed that larger, faster-growing individuals may emigrate first, and smaller individuals may remain and migrate later (Beakes et al. 2010; Satterthwaite et al. 2010). Not all individuals can migrate for instance in February and March. Hence, the amount of smolt passage, and the temporal variability on when this passage is provided, has a relationship with smolt outmigrant class survival and success. Therefore, modeling must account for this in some way. Even so, because significant overlap in immigration and emigration occur for both species, pulse flows can be used to facilitate both migration states. In short, the objective is to provide passage conditions adequate to facilitate outmigration of the offspring of at least 83 spawning pairs (e.g., 42 females x 5500 embryos), but aim to provide passage conditions that will support a larger, more sustainable population when possible.

PHYSICAL REQUIREMENTS

HABITAT RULES FOR WEAP

A fundamental concept relating salmonid production to stream habitat is stream-dwelling salmonids either defend or rely on a territory to support reproduction or to meet general caloric intake needs.

For estimating the amount (area) of spawning habitat needed, we assumed the maximum number of individuals that a specific habitat can support is limited by fish territory size and amount of available suitable habitat.

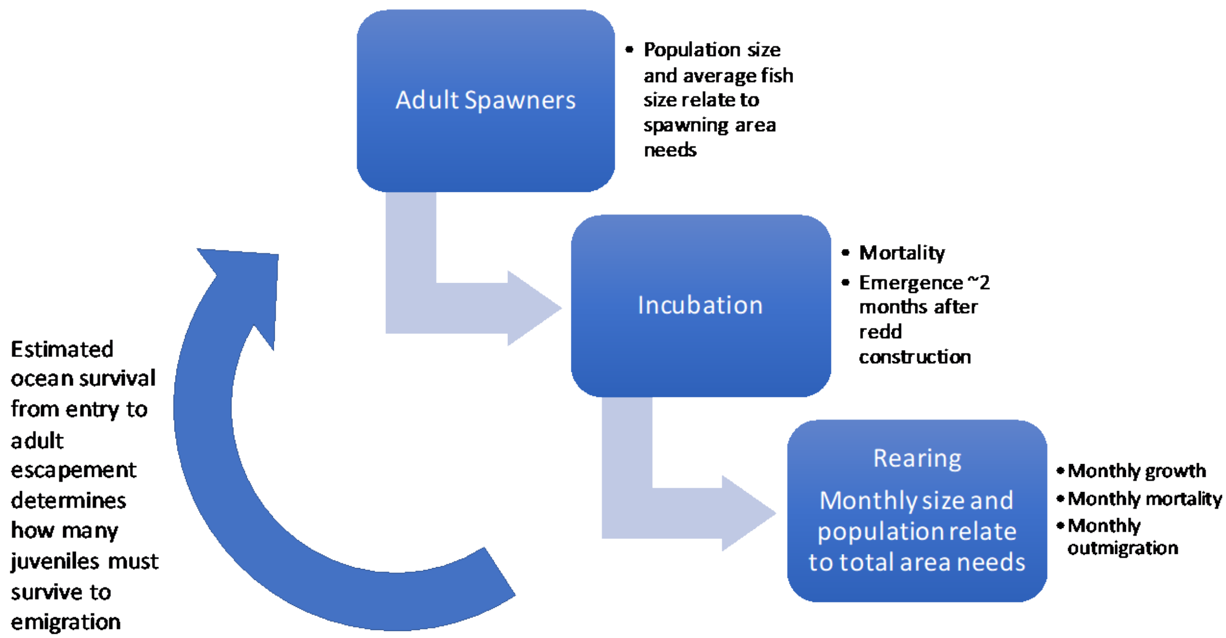
We assumed salmonids, whether spawning or rearing, will set-up territories in habitat that meets preferred range of non-consumable habitat conditions (temperature, depth, velocity), defined as available suitable habitat (ASH).

SPAWNING AND INCUBATION NEEDS

Unlike passage, which requires facilitation of movement between habitats, physical habitat that successfully supports a specific lifestage typically requires an area of habitat that supports the physiological needs of that lifestage. During these stages, a territory is often developed by individuals to reduce competition for resources (e.g., food, cover) and density-dependent stressors such as disease, oxygen consumption, redd superimposition and energy wasted on aggressive behavior, etc.

We have developed a simple model relationship between a population and the area of habitat needed to facilitate spawning, incubation, and rearing for that population. The model estimates the amount of suitable habitat required to sustain the number of fish of each lifestage of each species present for each month throughout the expected period that each lifestage is expected to be present (Figure 3). The WEAP model can then be used to estimate the flow needed to inundate potential habitat for each ROI where that lifestage is expected to occur for each of the calculated monthly habitat needs.

Figure 7. Conceptual Model for Estimating Chinook salmon and steelhead spawning, incubation and rearing needs.



SPAWNING

Adults require water deep enough over suitable spawning substrates to facilitate redd construction and redd defense and adjacent pools deep enough to seek shelter. Minimum temperature requirements must also be met through the spawning period. The objective is to release enough flow to meet depth and temperature requirements within each ROI in order to support spawning habitat if restored in sufficient amounts (i.e., areas) to support at least 83 spawning adults but aim for enough to support a population at low risk of extinction.

Estimates of sufficient spawning area are also dependent on fish and redd size. Because we do not have long-term, complete population data for Chinook salmon or steelhead in the Three Creeks and fish flows have not been provided to date, we used spawning Chinook salmon and steelhead population demographics from the Russian River using counts and length data from the Warms Springs Hatchery (2004-2014).

Table 3. Identified minimum population size (83 assumes high extinction probability and 833 assumes low).

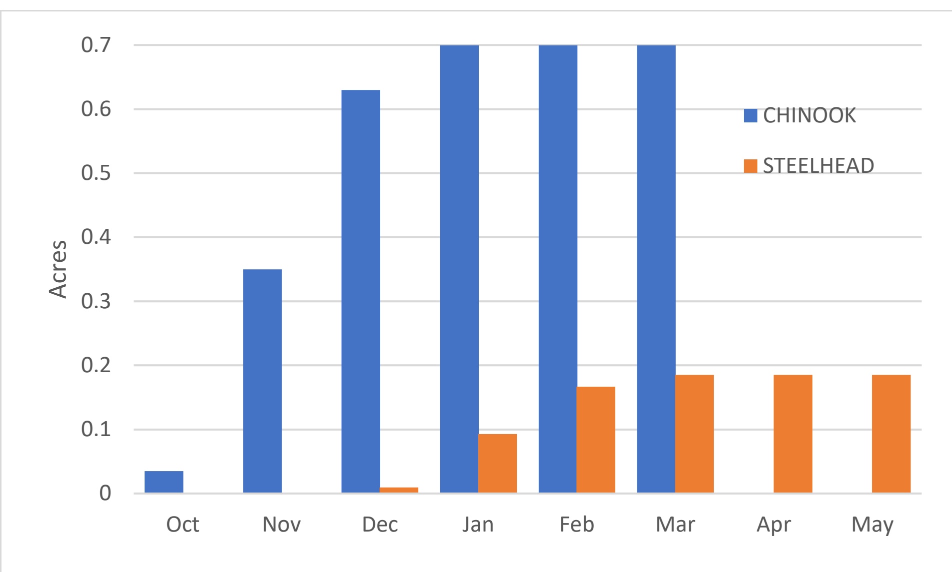
	Steelhead	Chinook
Minimum adult escapement	83 High Risk; 833 Low Risk	83 High Risk; 833 Low Risk
adult mean length (in)	26.35	27.41
adult min length	14	15
adult max length	39	38

We used the mean redd area for Chinook salmon and steelhead from Gallagher and Gallagher (2005) and multiplied it by the number of females (83 or 833) and divided by 2.

Steelhead spawning area needs range from an estimated = (83/2) * 1.78 m^2 = 73.87 m^2 (0.019 acres) to support minimum spawners, to an estimated (833/2)*1.78m^2 = 741.37m^2 (0.19 acres) for 833 spawners (Figure 5).

Chinook salmon spawning area needs range from an estimated = lower (83/2) * 6.72m^2 = 279 m^2 (0.07 acres) to support minimum spawners to an estimated (833/2)*6.72m^2 = 2799 m^2 (0.7 acres) to support 833 spawners.

Figure 8. Estimated acreage of spawning habitat needed per month for fall-run Chinook salmon and steelhead populations assuming 833 spawners per population and 1:1 sex ratio.



INCUBATION

Since young (e.g., embryos and alevin) cannot move during incubation period, ROIs that can facilitate spawning must have sufficient flow to keep spawning areas sufficiently cool and oxygenated to support incubation to successful emergence. That is, if the last redd is constructed in ROI 3 during the second week of April, then water and temperatures must be kept deep and cool enough so that 850 thermal units (TU) is reached (and TU of species are not exceeded) so fry can emerge and move to rearing areas. The objective is to provide enough habitat to support the offspring of at least 83 spawning pairs (e.g., 42 females x 5500 embryos) but aim for enough to support larger, more sustainable population. We assume the same area for spawning is needed for incubation (see Figure 8).

To calculate the number of embryos we used the length to fecundity relationship of Kaufman (2009) and Hodge et al. (2014) and the mean FL for steelhead and Chinook salmon provided above.

The average steelhead fecundity equals 4402, and average Chinook salmon fecundity equals 4690.

With a population of 83 adults, we assumed 182678 embryos available for steelhead.

For Chinook salmon population of 83 or 833 adults, assume 195,329 to 1,953,293 embryos.

For fry to emergence survival, we used the estimates of Cobble (1961), Hobbs (1940) and Dahlberg (1979).

This provided 73071 steelhead fry to emergence and 177,109 to 1,771,095 Chinook salmon fry to emergence.

To estimate emergence timing, we assumed a ~2-month lag behind redd construction (2-month incubation period) for both Chinook salmon and steelhead based on East Bay Municipal Utility District's spawning surveys of both species (2008-2014).

REARING

Using TU from the literature for incubation and emergence for each species, we estimated the fry period to extend from construction of the first redd to completion of the last redd. For reaches expected to support fry rearing, it is important to ensure that minimum depths and temperature requirements are met (at least) for the fry period in each expected rearing reach. As the transition to the juvenile period occurs, it is important to keep depths and temperatures within rearing limits in each ROI where potential rearing habitat occurs. It is recommended to use habitat maps to determine what the best depth is for the rearing reaches to determine the base rearing flow. It is important to provide enough habitat to support rearing of offspring of at least 83 spawning pairs (e.g., 42 females x 5500 embryos), but provide habitat for larger, more sustainable population when feasible.

For number of juveniles entering the model, we used the emergence estimates from above. Because we did not have survival data for the Three Creeks, we applied an average monthly mortality rate to rearing juveniles so that the modeled number of juveniles emigrating from each population would return 83 or 833 adults using the ocean survival rates of 2% for steelhead and 2.9% for Chinook salmon (Hallock et al. 1961; Thedinga 1998; Welch et al. 2000).

For Chinook we assumed all juveniles emigrated by the end of June and used the emigration rates of Zeug et al. (2014) and Giorgi et al. (1997).

For steelhead we assumed juveniles emigrate at Age 0, Age 1+ and Age 2+ and used the emigration rates from the Russian River Watershed as cited in Martini-Lamb and Manning (2005) to estimate the proportion of the cohort remaining in each creek on a monthly basis.

For monthly fish size, we used the monthly average FL of Chinook salmon and steelhead presented in Merz et al. (2016).

We calculated the average territory size for each monthly modeled FL size using the equation from Grant and Kramer (1990) and multiplied this by the modeled number of juveniles remaining to rear for each month.

ESTIMATED REARING NEEDS

Estimated steelhead rearing area needs ranged from a low of 8.5 acres during June to a little over 17 acres in February for the high-risk population and 40 acres during June and 171 acres in February for the low risk population (Figures 9-11).

Estimated Chinook salmon rearing area needs range from a low of 0.2 acres in May to a little over 1.8 acres in February for the high-risk population, and 0.1 acres in June and 18.1 acres in February for the low risk population (Figures 9-11).

It is important to note that habitat is not only related to temperature, depth, and velocity, but is often related to other factors, including proximity to complex cover or specific substrate types (see Wheaton et al. 2004; Grant and Kramer 1990). Also, fish rarely utilize all suitable habitat, but often select specific habitat types that are a subset of all available suitable habitat, and selected habitats are likely defined by complex gradients of previously listed factors (depths, velocities, substrate types, cover types, available food in close proximity). This exercise is meant to estimate the potential to support viable populations of Chinook salmon and steelhead within the present channel template and water availability within the multi-use regime of the Three Creeks. We acknowledge that capacity defined by estimates of available suitable habitat may be an overestimate. Furthermore, given the current condition of the stream channels, highly altered conditions, entrenched channels, poor sediment transport, poor water quality, pollution and vastly altered watershed processes shaping these systems, these streams may presently provide less suitable habitat versus what the WEAP model predicts. Future actions meant to rehabilitate, restore and mitigate these habitat quantity/quality issues can be incorporated into future adaptive management actions.

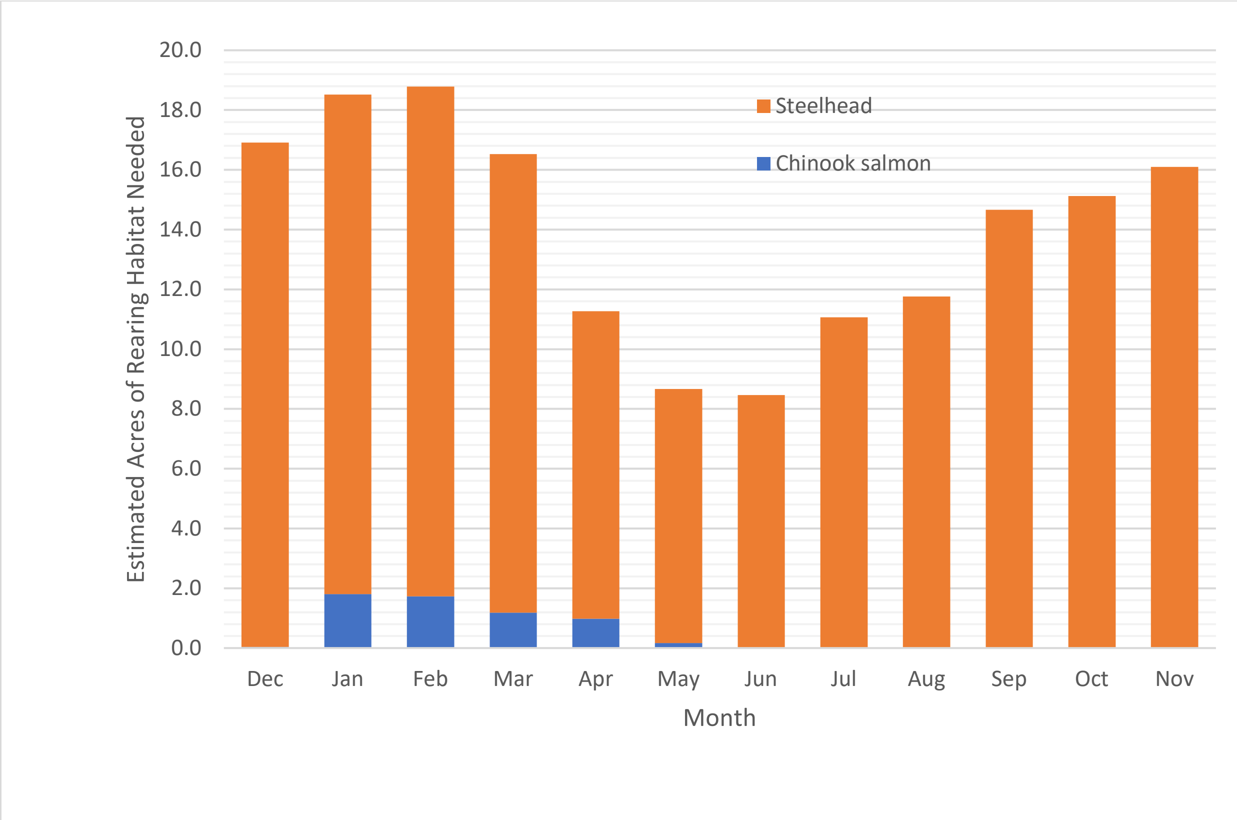


Figure 9. The modeled acreage needed for monthly rearing of Chinook salmon and steelhead assuming minimum population (83 individuals of each species and each population).

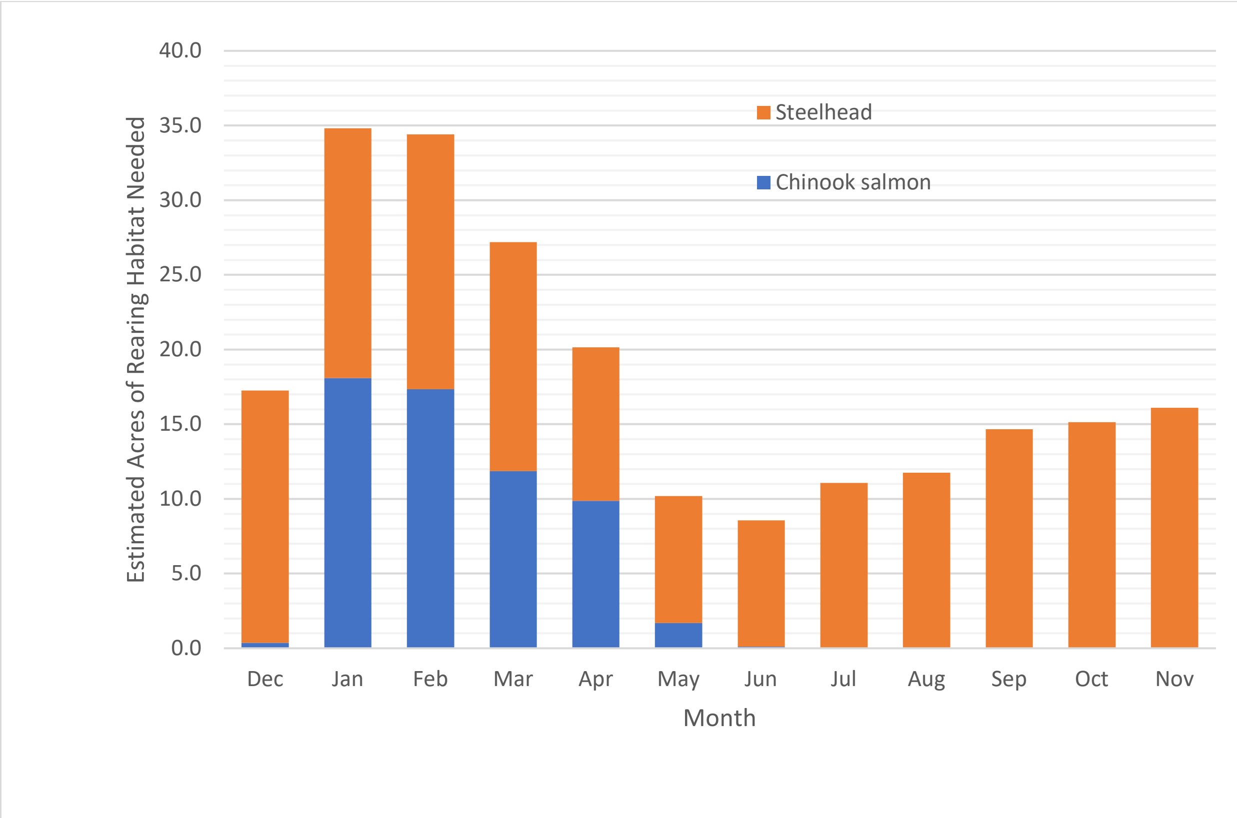


Figure 10. The modeled acreage needed for monthly rearing of Chinook salmon and steelhead assuming minimum population (83 individual steelhead and 833 Chinook).

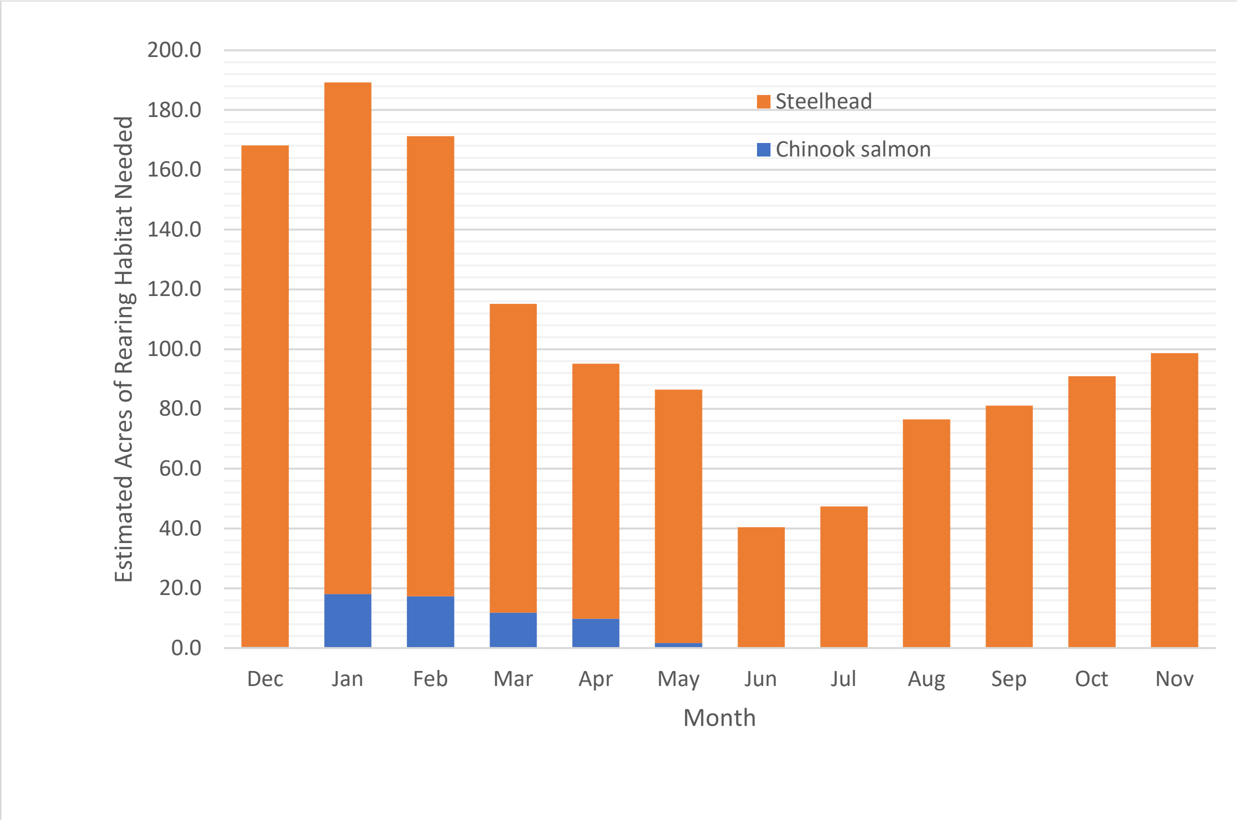


Figure 11. The modeled acreage needed for monthly rearing of Chinook salmon and steelhead assuming minimum population (833 individual steelhead and 833 Chinook).

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Attachment 1.2

Technical Work Group

collaboration, progress, success, future

SCVWD, California Department of Fish and Wildlife, National Marine Fisheries Service, Trout Unlimited, CalTrout, and GCRCD.

Progress

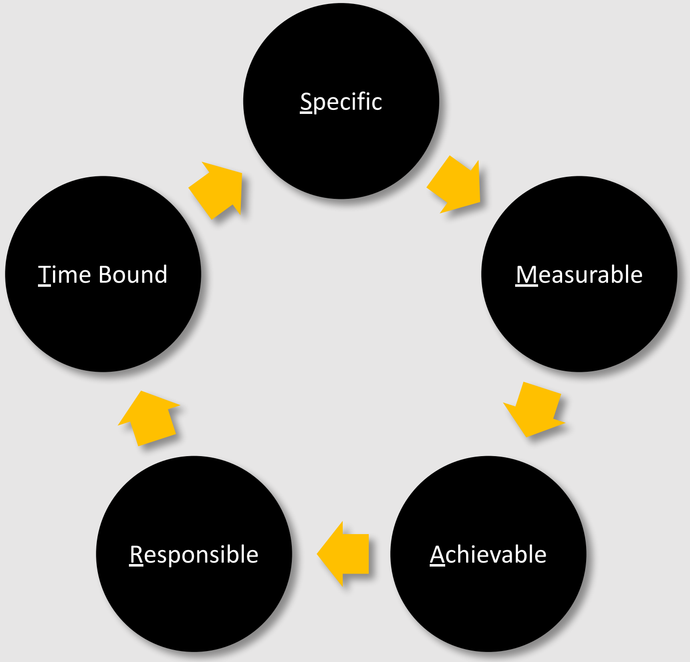
- Habitat restoration… relatively young, evolving science but numerous examples of successful implementation
- Completion of FAHCE Settlement and restoring populations to good condition are a reality
- TWG still has technical issues to work out but these can be resolved in timely manner

Quantifying goals

SETTING TARGETS AND MEASURING PROGRESS AND SUCCESS (SCVWD 2016)

- *Attribute: important characteristic that helps describe an objective. A useful attribute an be measured in a scientifically defensible way.*
- *Metric: parameter that can be measured to track the status of attributes. Each attribute will be measured and tracked via one or more metrics.*
- *Target- optimistic but achievable endpoint, quantified where possible to indicate success.*
- *Assess progress in meeting objectives by tracking attributes through specific metrics and targets.*

SMART Goals

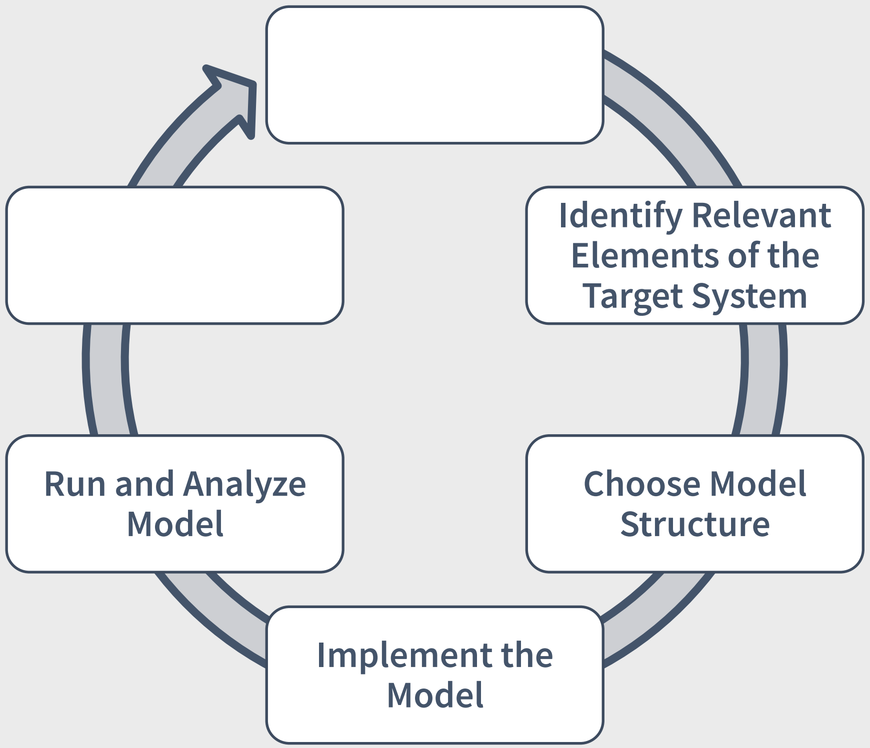


Measureable targets help us confidently determine what it takes to be successful.

Salmonid populations in good condition

- We have not determined overall population goals but we can use genetics to determine a minimum viable population (Frankham 2005; Frankham et al. 2015)
- We do not have exact population behaviors nor their response to Three Creeks environment but we do have general information from surrogate watersheds as a starting point
- In short, sustained populations require enough young from adults to support enough returning fish so that population will not go extinct in the foreseeable future

Value of Modeling Exercise

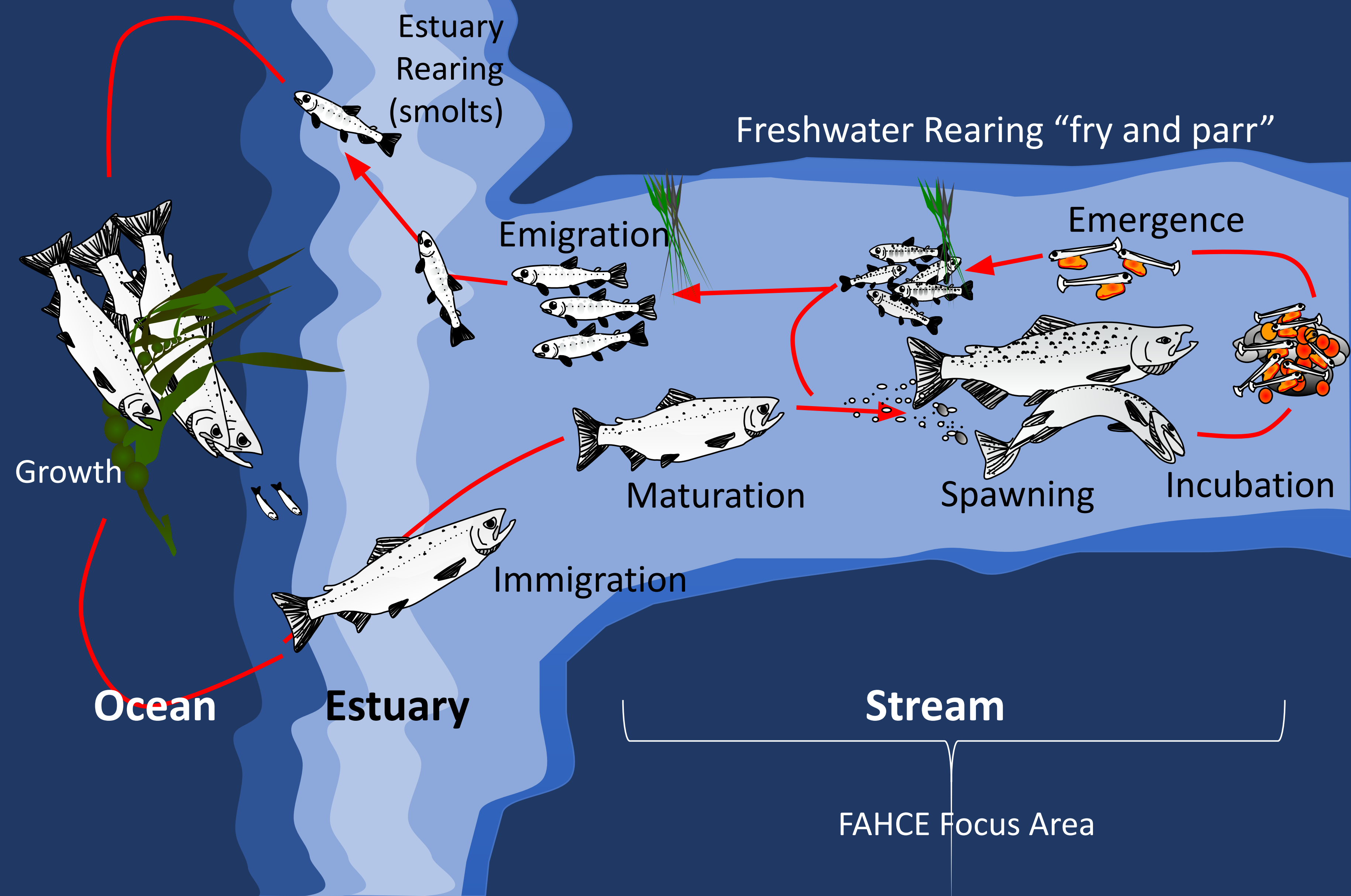


- Models help **quantify and visualize potential benefits of flow and non-flow actions** on target organisms
- **Quantify** lifestage-specific and **cumulative impacts of restoration actions** on each salmonid population
- Allows **comparison of benefits** identified **under different** flow/management **alternatives**
- Helps **determine** when "**enough is enough**"
- Model **identifies gaps** in understanding
- **Iterative process** whereby new information will fill knowledge gaps
- Allows District and stakeholders to "game" habitat quality and available water to **wisely manage** flow and non-flow actions
- Provides **transparent process** to determine management actions
- Facilitates **adaptive management**

Model basis: Steelhead and Chinook must access and use a range of habitats to be successful...

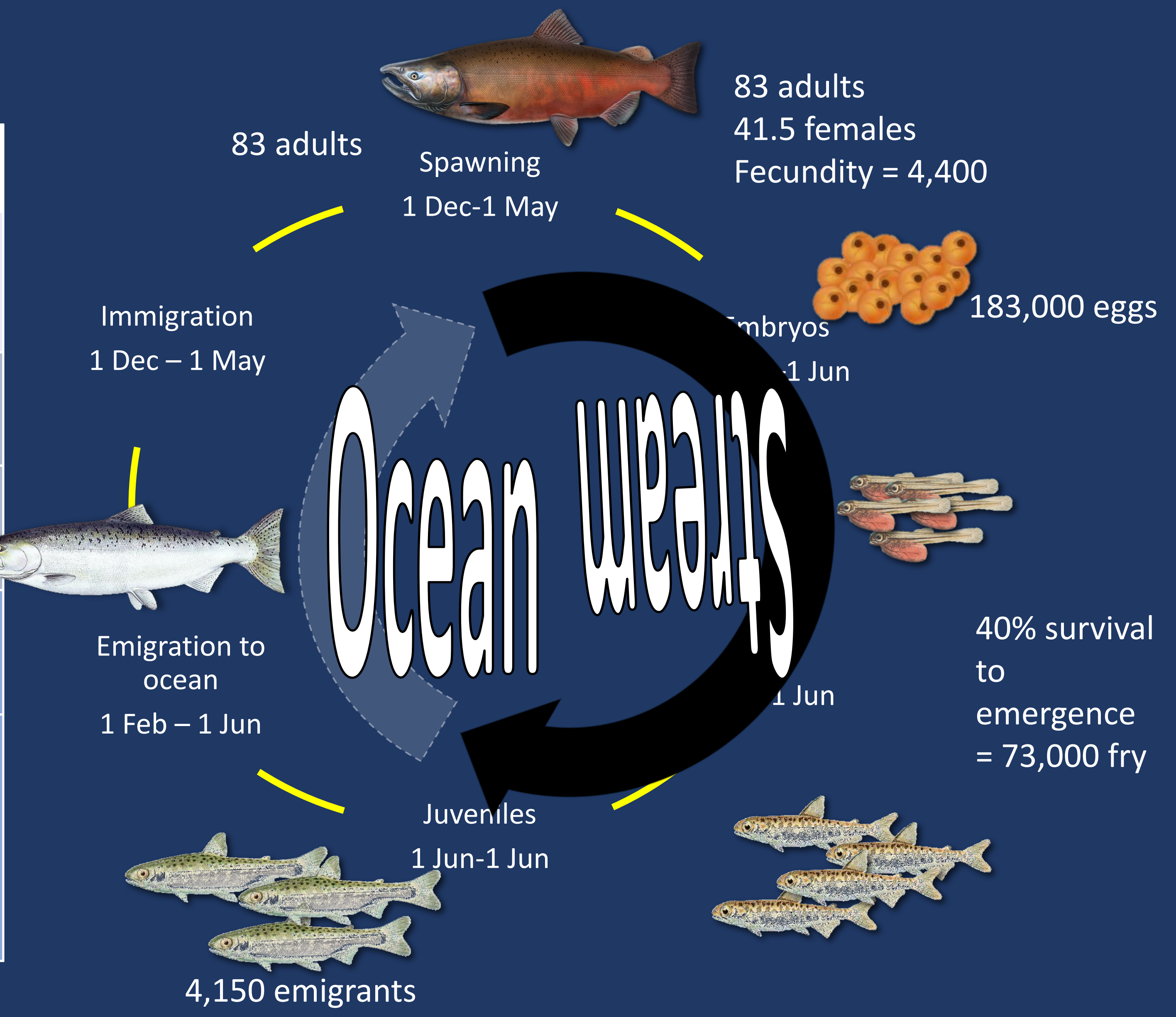
What is successful? Population target must be met for each life stage to maintain the quantity and quality of fish that is acceptable as... "in good condition"

To do this, not only enough habitat is needed to support each life stage but habitat must be accessible and functioning when each life stage needs it.



Model basis is minimum population Steelhead example

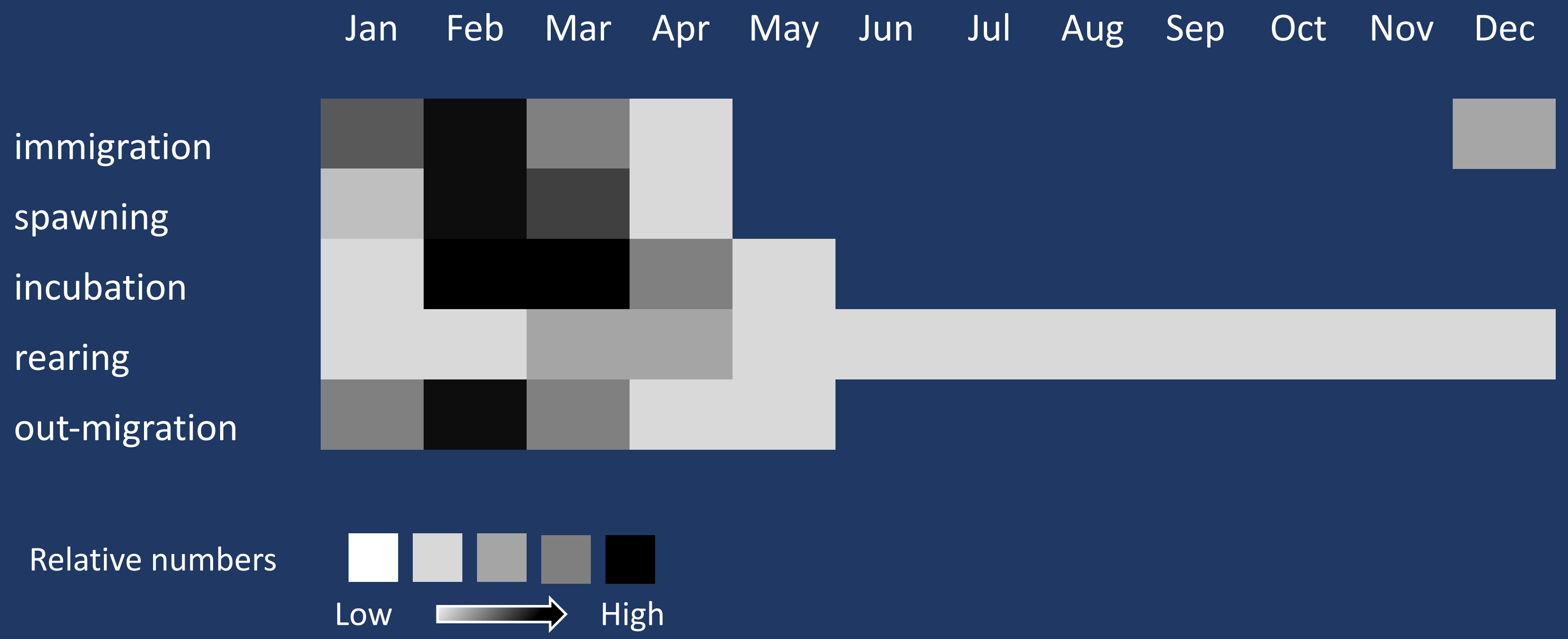
Function	Parameter	Data Source	Function of…
Initial Abundance	83 adults	NOAA (2008); Frankham et al 2015	Minimum viable population
Fecundity	4,400 eggs	Hodge et al 2014	Length to fecundity ratio
Fry abundance	73,000 fry	Coble 1961; Hobbs 1940; Dahlberg 1979	Incubation survival
Emigration Rate	Migration Speed	Lagunitas Creek MCWD Rotary Screw Trap	Fish Length, Flow
Survival	4,150 emigrants	Hallock et al 1961; Thedinga 1998; Welch et al. 2000	Minimum population reaching ocean to facilitate adult escapement numbers



Population and WEAP models support efficient water management

If we only use a general concept of when steelhead migrate, how much water is needed for immigration?

Generalized California steelhead timing



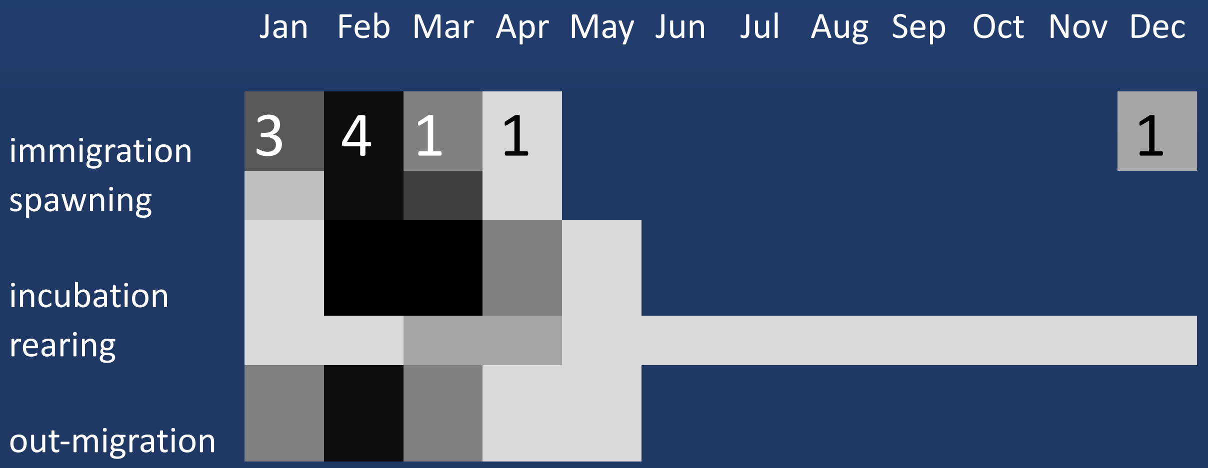
Guadalupe Creek passage = ~150 days of passage

Under FAHCE agreement 0.8 ft of water needed in channel to pass steelhead.

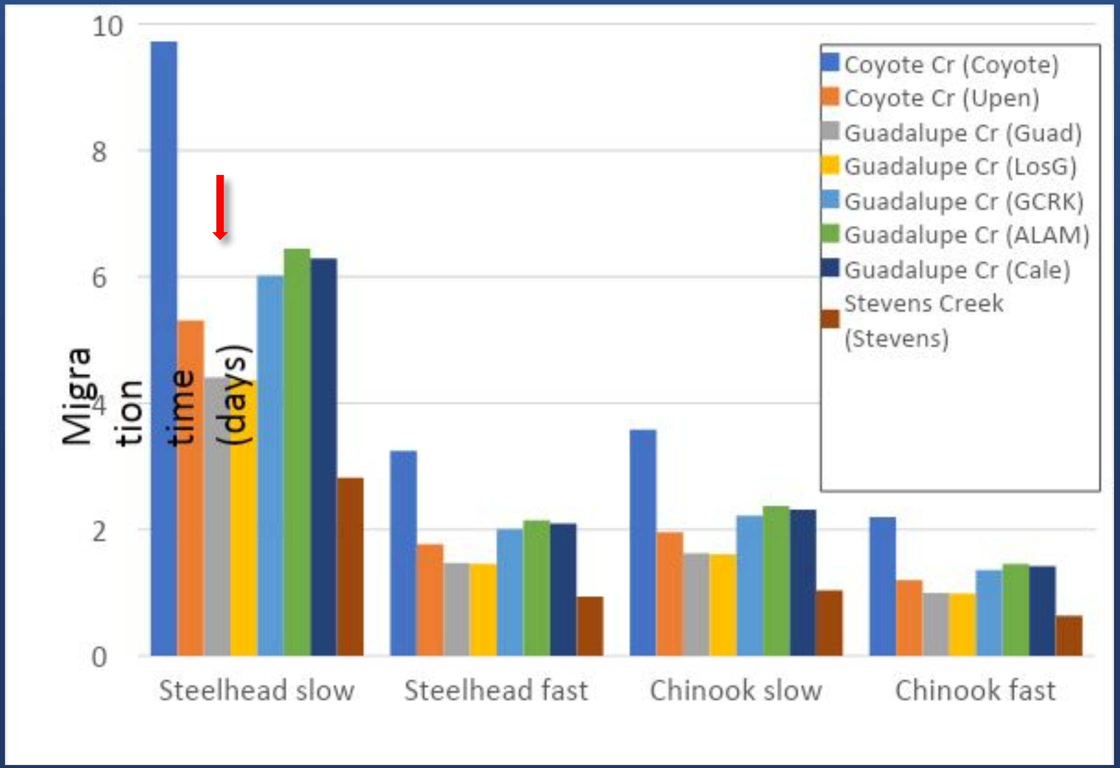
Requires ~41 cfs = 81.3 ac ft/d = 12,198 ac ft

Conceptual model example supports 70% less water used

Generalized California steelhead timing. Number of steelhead passage events under unimpaired flows for below normal water year.



Numbers are estimated average monthly passage events under unimpaired flow



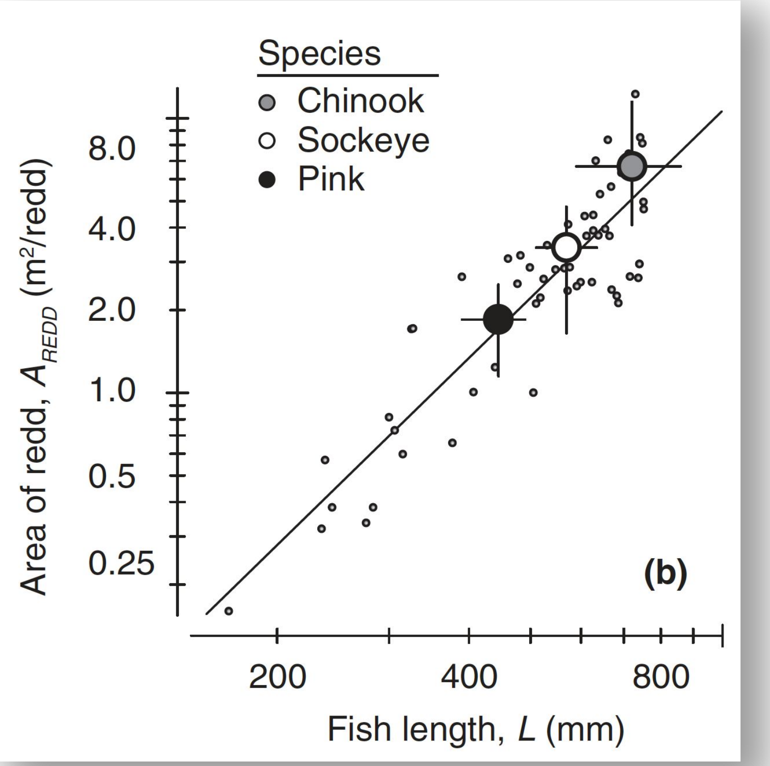
Estimated number of days for steelhead and Chinook to immigrate from bay to spawning grounds for reach creek using migration speeds of Keefer et al. (2004).

Under unimpaired flow, a total of 10 passage events occur during steelhead immigration period (below normal WY).
Using steelhead migration speeds assume 4.5 days for average fish to reach spawning grounds = 45 days of passage
45 days of 41 cfs = 3659 ac ft.

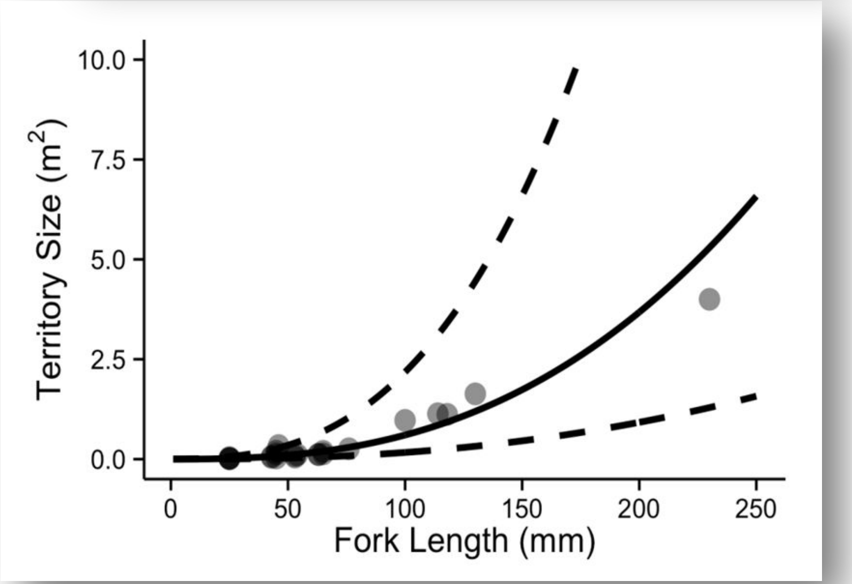
Fundamental concept relating salmonid production to stream habitat

- Stream-dwelling salmonids either defend or rely on food from a characteristic area of territory.
- We assume maximum number of individuals a habitat area can support is limited by territory size of fish and amount of available suitable habitat (ASH):

Capacity = ASH / Territory Size

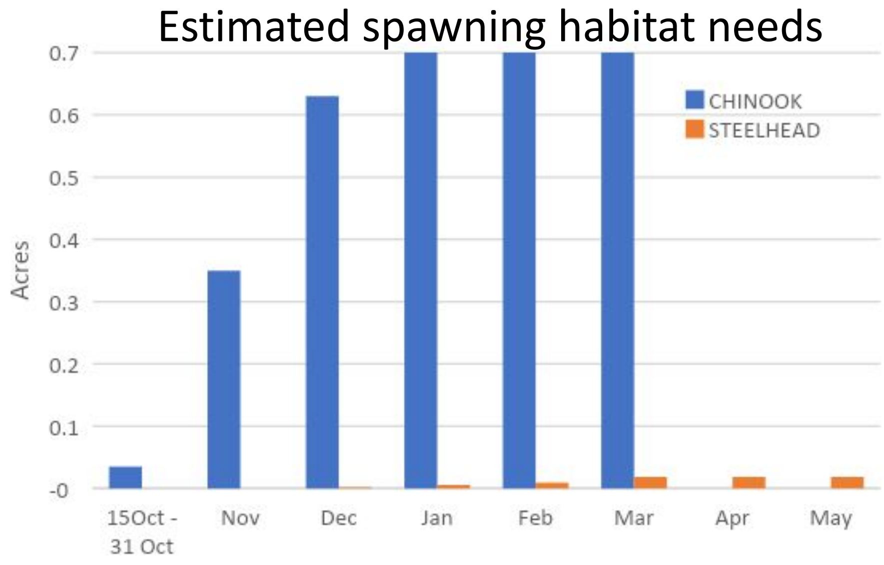


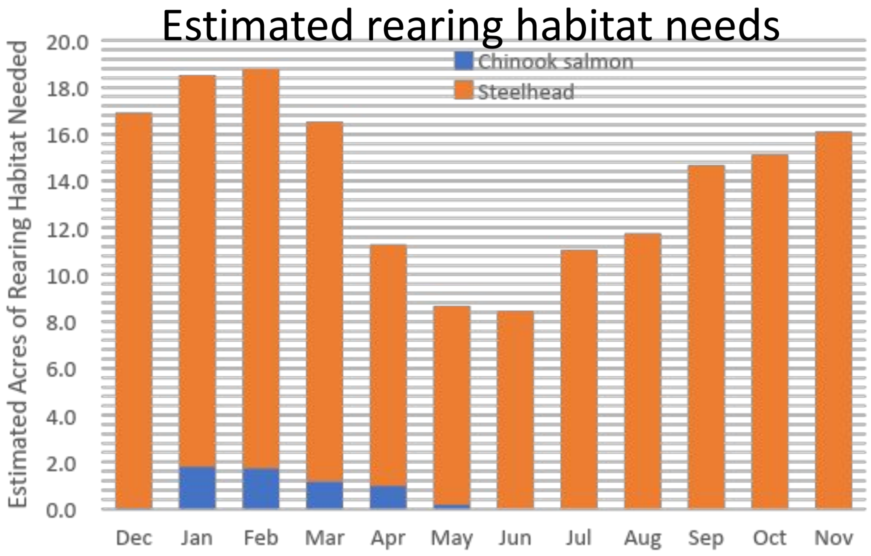
Riebe et al. 2014

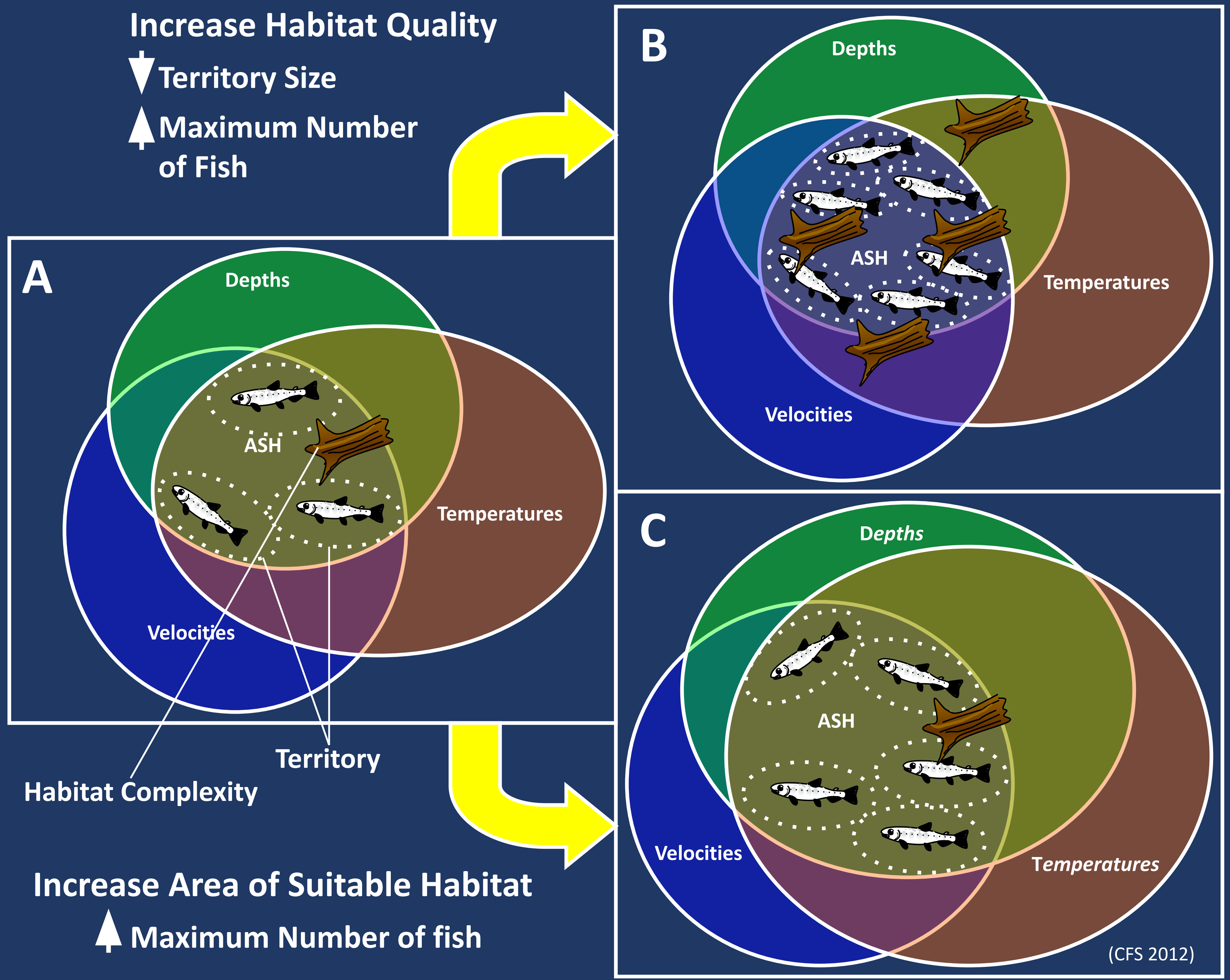


Grant and Kramer 1990

Territory and Habitat needed






Increase Habitat Quality
Territory Size
Maximum Number of Fish
A
Depths
ASH
Temperatures
Velocities
Territory
Habitat Complexity
B
Depths
ASH
Temperatures
Velocities
C
Depths
ASH
Velocities
Temperatures
Increase Area of Suitable Habitat
Maximum Number of fish
(CFS 2012)

Recommended Next Steps

- Study Plan backbone is the Water Evaluation And Planning (WEAP) Model
- WEAP model produces time series simulating reservoir storage, streamflow, temperature, diversions, and operational variables, and is used as a comparative model.
- When synced with habitat suitability and 1-D (HEC-RAS) modeling, the tool could potentially predict the quantity of habitat available for target life stages of steelhead and Chinook.
- Modeling exercises require validation- Part of validation exercise is comparison of model results against a time period in which operations are known.
- Team agreed that work plan will have a validation component and a decision point regarding model uncertainty. Flows, in particular, will be validated. These data will be used to predict habitat availability and ability to pass fish under alternative flow schedules.
- This modeling, once validated, could be an invaluable tool for future assessment of operation performance including support of adaptive management and biological monitoring.